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REVIEW

November 1958

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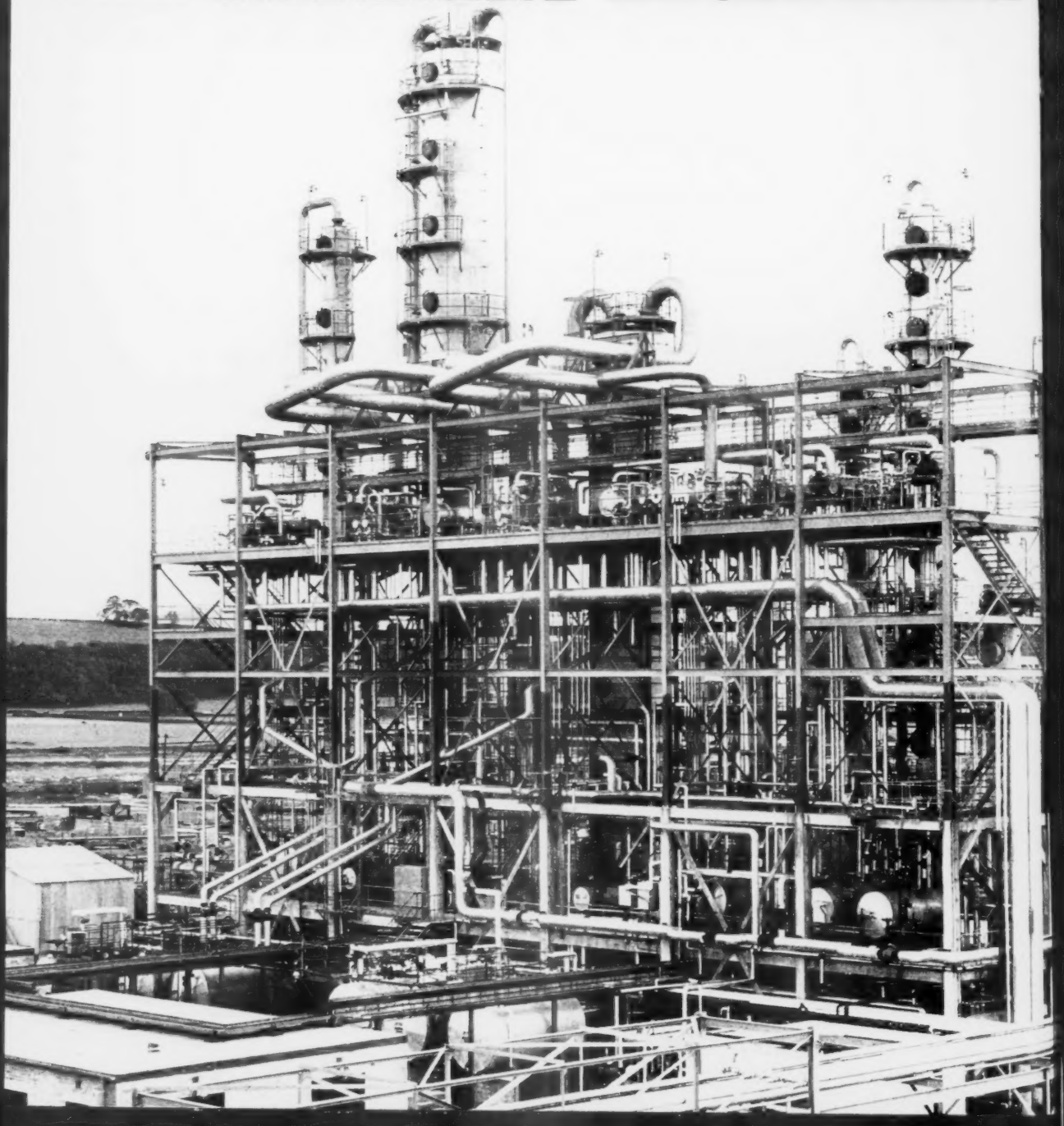

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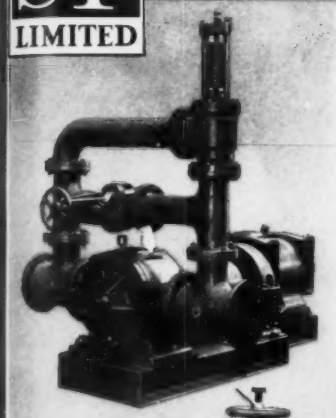
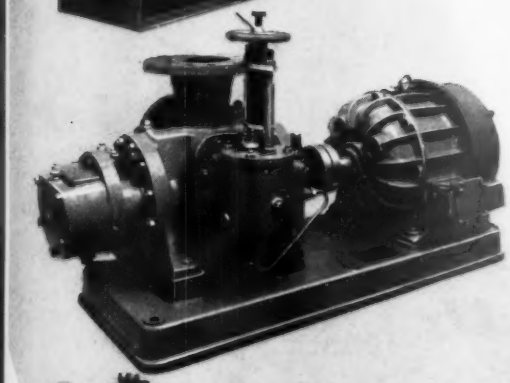
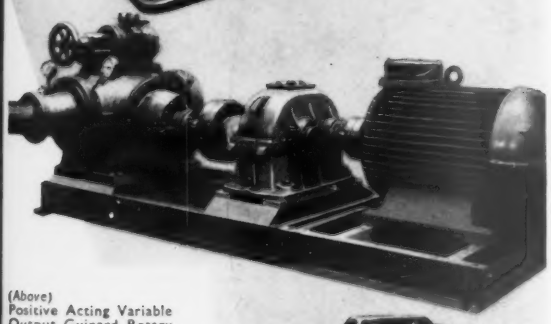


(Left)
Positive Acting Rotary Displacement Pump for the handling of Molasses and viscous fluids, electrically driven through totally enclosed Reduction Gear Box.

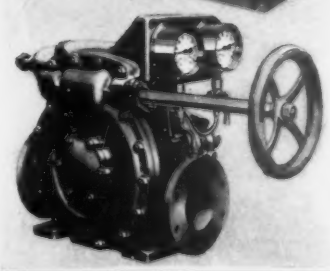
(Below)
Suitable for handling Spirits and other volatile fluids, this Screw Displacement Pump is of the all round clearance design and is capable of working with a high suction lift. The flow is practically pulseless and the unit self priming.





(Above)
Positive Acting Variable Output Guinard Rotary Piston Pump. Electrically driven through Reduction Gear Box, for Oils of varying viscosity.

(Right)
Reversing Flow Rotary Displacement Pump for fitting on tank wagons. These pumps are driven from a power take-off on the gear box.



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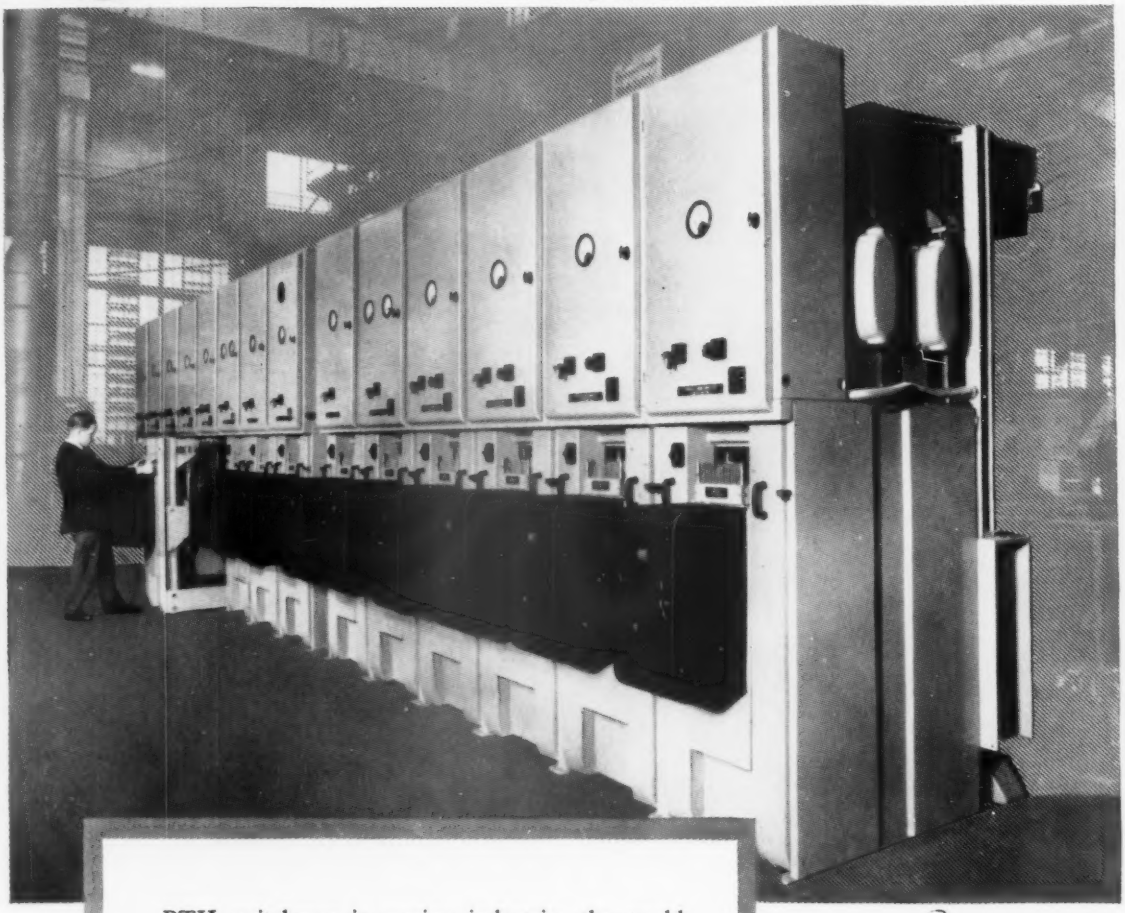

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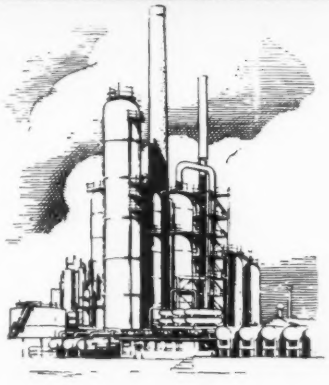

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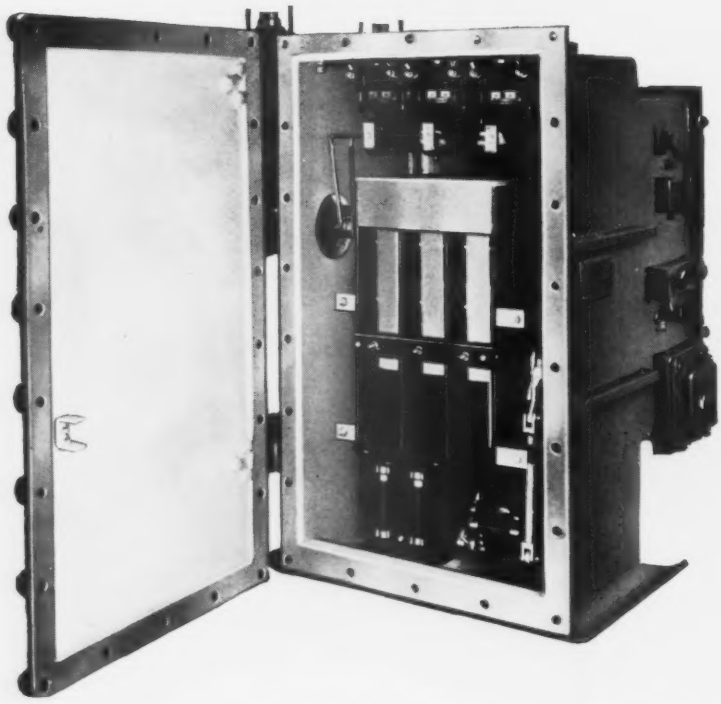

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Pipe lines on the Hydrocarbon Fractionation Unit, at the new Shell Chemical Plant, Stanlow, near Chester, England. (A Shell photograph).

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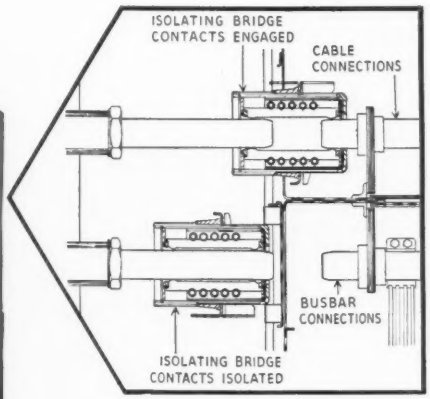

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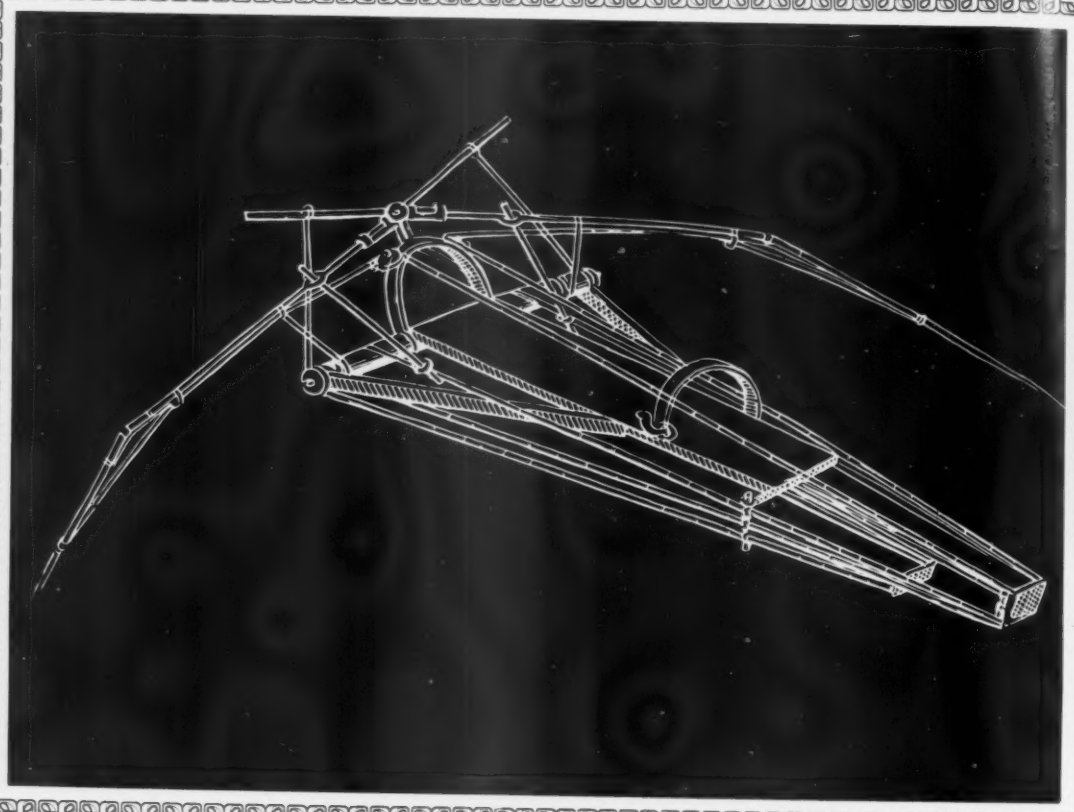

From a Science Museum photograp

Wright and . . . not necessarily wrong

MEN HAD DREAMED of flight for thousands of years before 1903, when the Wright brothers changed dream to reality. One of the most practical dreamers of older times was Leonardo da Vinci, whose drawing for the mechanism of a flying machine is illustrated here. Before we scoff at this attempt to reproduce the mechanisms of a bird's wing, we should remember that the Russians are said to be experimenting seriously with flapping-wing aircraft today.

Indeed, between Leonardo's dreams and the practical achievement of the Wright brothers, differences in design may well have been less important than the difference in available power. It was the light-weight power of the internal combustion engine that lifted man into the air; and it was the oil industry that made available the fuels and lubricants for the internal combustion engine. The era of flight had to wait for the era of oil.

Vacuum Oil Company—now Mobil Oil Company—was founded in 1866, only seven years after the sinking of the first commercial oil well. The company has pioneered many of the technological advances that have translated da Vinci's dreams into the familiar realities of today. Incidentally, there was Mobiloil in the engine of the Wright brothers' plane when man first took to the air.

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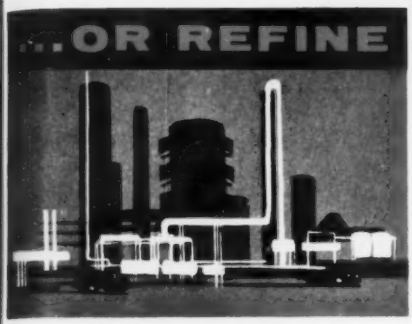

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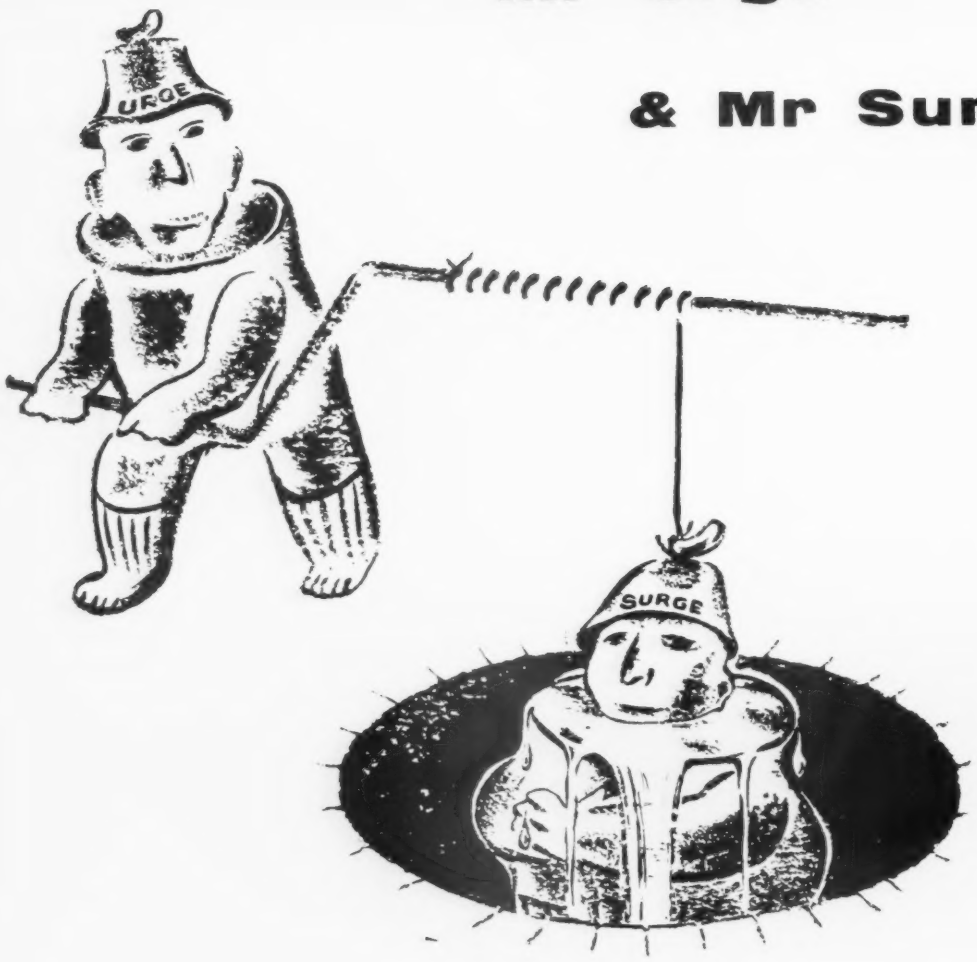

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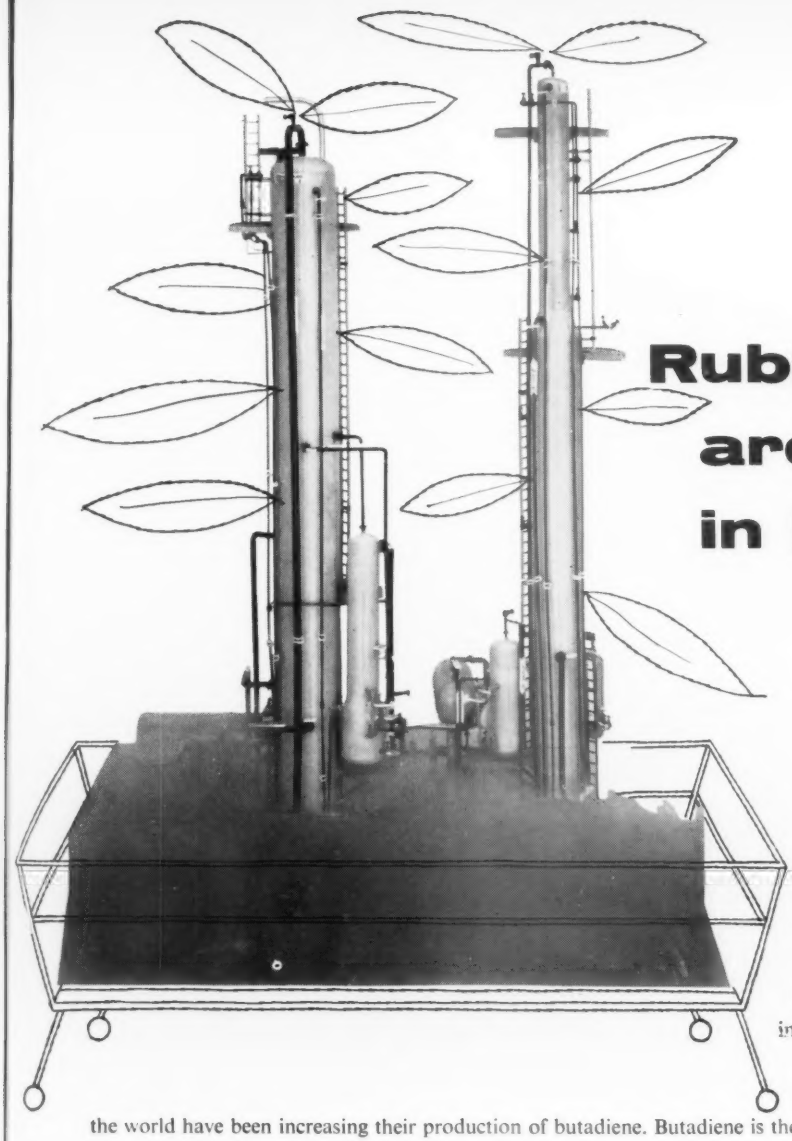

Rubber Plants are growing in England...

The steady increasing demand for synthetic rubber explains the growth of these relatively new petrochemical plants in England. In recent years leading petrochemical and petroleum firms not only in the United Kingdom but throughout the world have been increasing their production of butadiene. Butadiene is the major constituent of the general purpose rubber called GR-S. The Kellogg organisation has been associated with several of these projects.

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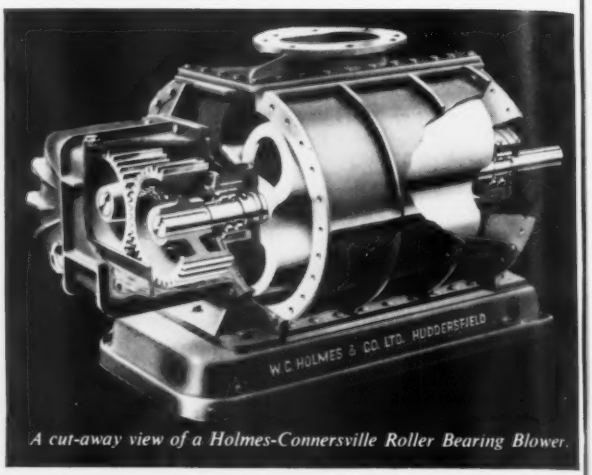

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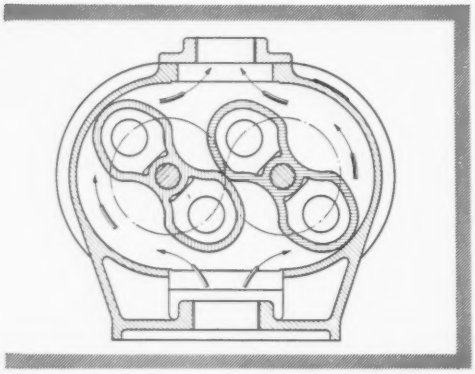

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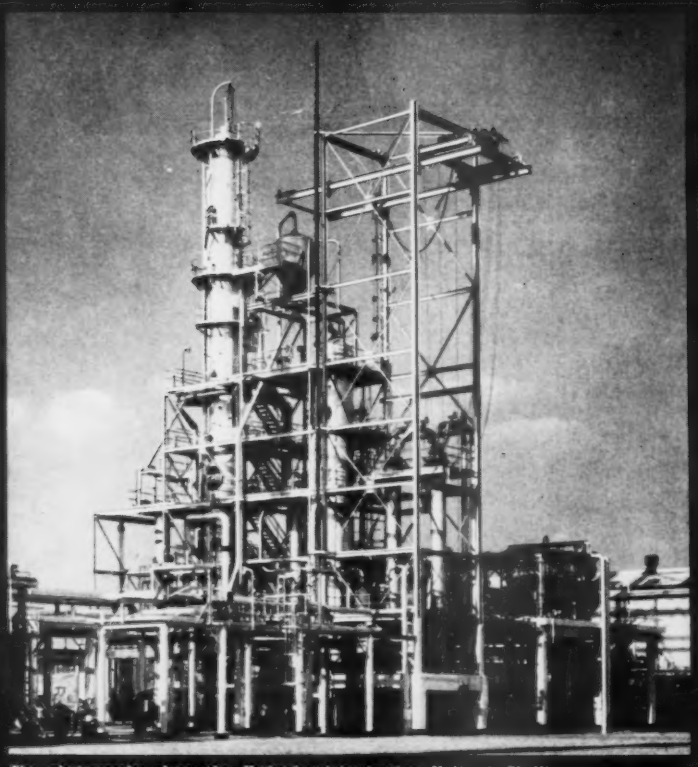

The photographs show the Hydrodesulphurisation Unit at Shell's Stanlow Refinery and are by courtesy of the Shell Petroleum Co. Ltd.

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*Lubrication in the Nuclear Age**

Developments in the use of nuclear energy present new problems to the oil industry. Whilst many of the requirements of a nuclear power station are covered by conventional lubricants (such as turbine oils), other requirements (Fig 1) call for lubricants having special properties. For example, the CO_2 circulating fans need an oil which has low vapour pressure so that little oil will pass into the gas stream and contaminate the reactor. The oil should have low solubility for CO_2 so that no CO_2 (which may be slightly active) is held up in the gas separation equipment.

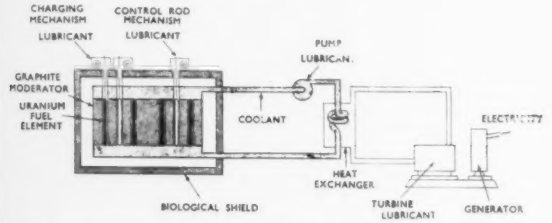


Fig. 1. Simplified flow diagram of a nuclear power station

A more rigorous requirement is that for certain applications the lubricant must be resistant to beta, gamma, and neutron radiation. Two applications for such lubricants in a natural uranium (graphite moderated) CO_2 cooled reactor can be summarized as follows:—

(i) Control Rod Mechanism

Release of energy in the reactor is normally controlled by boron steel rods which readily absorb neutrons. The rod-operating mechanism is located outside the biological shield, and ball, roller, and plain bearings and gears require lubrication at temperatures between 100°C and 200°C. The lubricant will also be exposed to small amounts of gamma rays, and will be expected to withstand these operating conditions for a number of years.

(ii) Charging Mechanisms

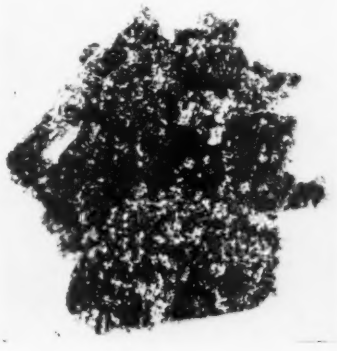
Some parts of the mechanisms used for charging and discharging the uranium fuel rods are inside the reactor and subject to intense radiation. Under these conditions, sliding surfaces require lubrication at temperatures (between 400° and 450°C) which preclude the use of hydrocarbon materials as lubricants, and dry lubrication (such as molybdenum disulphide and Sulfinuz treatments) is under consideration.

Other parts of the charging mechanisms are outside the reactor and these bearings require lubrication at temperatures up to 200°C in the presence of neutrons (and associated radiation) from the reactor, together with intense gamma rays from used fuel elements whilst these are in the machine. Although the temperature is lower here the radiation flux is significant.

The Effect of Nuclear Radiation on Lubricants

Since 1953 the problem of developing lubricants capable of withstanding the deleterious effects of nuclear radiation has been actively pursued at Thornton Research Centre. In collaboration with the AERE a wide range of materials has been irradiated in the BEPO pile at Harwell, and this work has been consolidated using a 250 curie cobalt-60 source of gamma rays. In addition, irradiations have been carried out using electrons from a 4MeV linear accelerator

Fig 2. Illustration of a hydrocarbon oil which has solidified during irradiation with neutrons



*Summary of a contribution by Dr C. G. Williams, director and general manager, "Shell" Research Ltd, at the 120th Annual Meeting of the British Association, 1958.

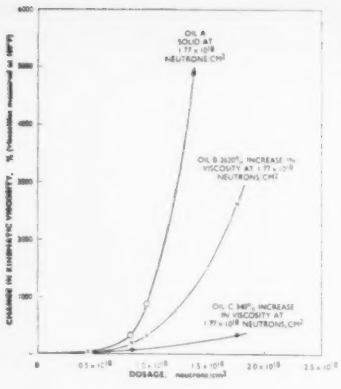

OIL A SOLID AT 1·77 × 10¹⁸ NEUTRONS/CM²
OIL B 262°F INCREASE IN VISCOSITY AT 1·77 × 10¹⁸ NEUTRONS/CM²
OIL C 140°F INCREASE IN VISCOSITY AT 1·77 × 10¹⁸ NEUTRONS/CM²
DOSAGE, neutrons/cm²

Fig 3. *Relationship between neutron dosage and per cent increase in viscosity* (*cS at* 100° *F*)

at Metropolitan-Vickers Electrical Co. Ltd, Manchester. The salient features from these investigations are as follows:—

(i) Hydrocarbon Oils

All hydrocarbon oils examined were found to increase in viscosity and eventually, in some cases, became solid at the higher pile dosages (about $1{\cdot}8 \times 10^{18}$ neutrons/sq.cm). These "solid oils" (Fig 2) had soft, jelly-like consistencies with melting points in excess of 220°C; they were incompletely soluble in solvents such as benzene, ethanol, and ether. Other oils, however, remained fluid at these high neutron dosages as shown in Fig 3. Oil A, a high viscosity bright stock, became solid, whilst oils B and C showed lower degrees of polymerization, the smallest change being that for the highly aromatic solvent-extract Oil C.

The polymerization of the oil occurs irrespective of the type of radiation used. If the results from separate experiments with neutrons, electrons, and gamma rays are reduced to a common energy absorption level, then a satisfactory correlation (Fig 4) is found for the three types of radiation in the effects they produce. Similar processes, therefore, are taking place under the three conditions. These processes (Fig 5) include:

(a) Energy transfer from the radiation to the hydrocarbon molecule;

(b) Dissociation of this energy-rich molecule into a highly reactive fragment accompanied by the evolution of gas (mainly hydrogen);

(c) The combination of active fragments to give compounds of higher molecular weight and viscosity.

A major factor which determines the resistance of an oil to the effects of nuclear radiation is the presence of aromatic compounds. Fig 6 gives the results for the pile irradiation of a series of hydrocarbon oils of differing aromatic content. The results clearly indicate that there is a significant decrease in radiation damage with increasing aromatic content. It is probable that the aromatic compounds are acting as "energy sinks" (Fig 7) and are able to dissipate absorbed energy without undergoing drastic changes leading to cross-linking and viscosity increases.

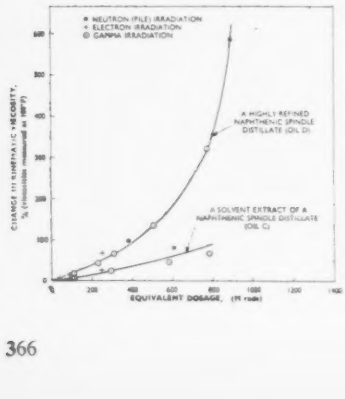

+ NEUTRON (PILE) IRRADIATION
× ELECTRON IRRADIATION
⊙ GAMMA IRRADIATION
A HIGHLY REFINED NAPHTHENIC SPINDLE DISTILLATE (OIL D)
A SOLVENT EXTRACT OF A NAPHTHENIC SPINDLE DISTILLATE (OIL C)
EQUIVALENT DOSAGE, (ft rads)

Fig 4. *Relationship percentage change in kinematic viscosity at* 100° *F and dosage for neutron, gamma and* β*-irradiated oils*

After irradiation with neutrons in the pile, many oils were found to be radioactive, the activity increasing with increasing sulphur content of the oil (Table I). This was traced to the presence of a radio-isotope of phosphorus, P-32, which emits electrons and has a half-life of about 14 days. The isotope is formed from sulphur S-32 (present in most petroleum lubricants) by capture of a neutron followed by the ejection of a proton. After pile irradiation it is therefore necessary to allow oils to "cool" to a low level of activity before examination in the laboratory. Unlike neutrons, however, gamma rays do not give rise to induced radioactivity, and gamma-irradiated samples can be safely handled immediately after test.

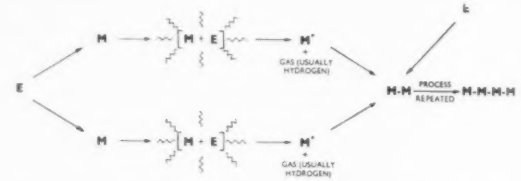


Fig 5. *Diagrammatic illustration of the degradation of hydrocarbon molecules when exposed to radiation*

(ii) Greases

Greases have poor radiation stability, becoming liquid at relatively low dosages. These changes are virtually independent of the type of base oils used in preparing the grease,

TABLE I

EFFECT OF SULPHUR CONTENT ON RADIOACTIVITY OF OILS AFTER PILE IRRADIATION

Dosage: $1{\cdot}27 \times 10^{18}$ Neutrons/sq. cm

Sulphur content % w	*Count (above background)* p.p.s./cm²
<0·002	1
0·2	17
0·55	70
0·65	160
4·05	550*

Instrument: Geiger Muller Ehm 2 thin-window counter. Above measurements made approximately 2 months after removal of oils from the pile.

*Dosage of $0{\cdot}83 \times 10^{18}$ neutrons/sq. cm.

and are indicative of a significant breakdown in the structure of the gelling agent (Fig 8). One way to achieve a radiation stable grease is to use an inorganic gelling agent. Greases based on hydrocarbon oil have been shown to be stable to irradiation dosages as high as those which the base oil itself will withstand, and offer considerable promise in applications where grease, as distinct from oil, lubrication is desirable.

(iii) Synthetic Fluids

The phenomenon of polymerization under the influence of nuclear radiation extends also to many synthetic materials, *e.g.*, the well-known silicone fluids. In view of their high thermal stability and good viscosity temperature characteristics, various commercially-available silicones of differing viscosity and aromatic content have been irradiated. The non-aromatic polydimethyl siloxanes were the least stable, those containing aromatic groupings being more satisfactory. Fig 9 compares the radiation stabilities of the commercially-available silicones and a wide range of hydrocarbon oils; it is concluded that, as a class, hydrocarbon mineral oils are relatively stable materials under these severe conditions. Of the other synthetic fluids, di(2-ethyl hexyl) sebacate, which has been of interest in the past few years as a component of synthetic aviation gas turbine lubricants, was transformed into a solid and appears unpromising as a radiation-resistant fluid.

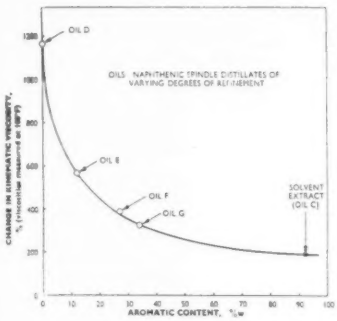


Fig 6. Relationship between percentage increase in viscosity (at a neutron dosage of $1 \cdot 27 \times 10^{18}$ *neutrons/cm²) and aromatic content*

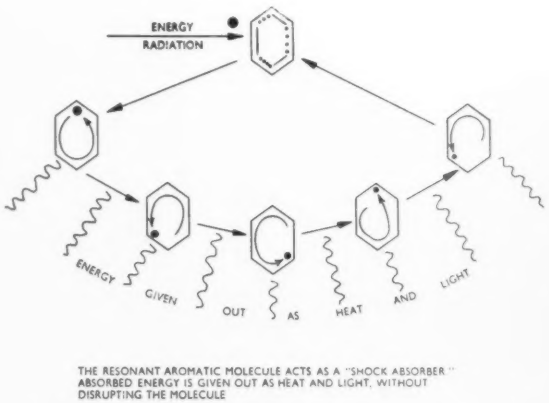

ENERGY
RADIATION
ENERGY GIVEN OUT AS HEAT AND LIGHT
THE RESONANT AROMATIC MOLECULE ACTS AS A "SHOCK ABSORBER" ABSORBED ENERGY IS GIVEN OUT AS HEAT AND LIGHT, WITHOUT DISRUPTING THE MOLECULE

Fig 7. Effect of aromatic compounds on radiation stability

Conclusions

As temperatures go higher and reactor neutron fluxes increase, the demand on the lubricants will also increase. In some reactors it is suggested that the reactor coolant will be circulated to the turbine directly. If the coolant is radioactive, then the turbine lubricant must be stable to radiation.

Radiation-resistant lubricants are already available to meet the known requirements of nuclear power stations at present under construction, but as experience is gained and progress is made in nuclear power equipment, new lubrication problems may well continue to arise. The presence of nuclear radiation adds a complicating factor to the already complicated field of lubrication.

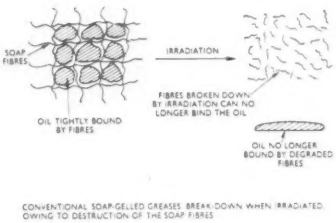

SOAP FIBRES
IRRADIATION
FIBRES BROKEN DOWN BY IRRADIATION CAN NO LONGER BIND THE OIL
OIL TIGHTLY BOUND BY FIBRES
OIL NO LONGER BOUND BY DEGRADED FIBRES
CONVENTIONAL SOAP-GELLED GREASES BREAK DOWN WHEN IRRADIATED OWING TO DESTRUCTION OF THE SOAP FIBRES

Fig 8. Breakdown of greases during irradiation

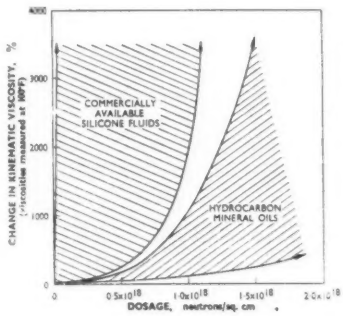
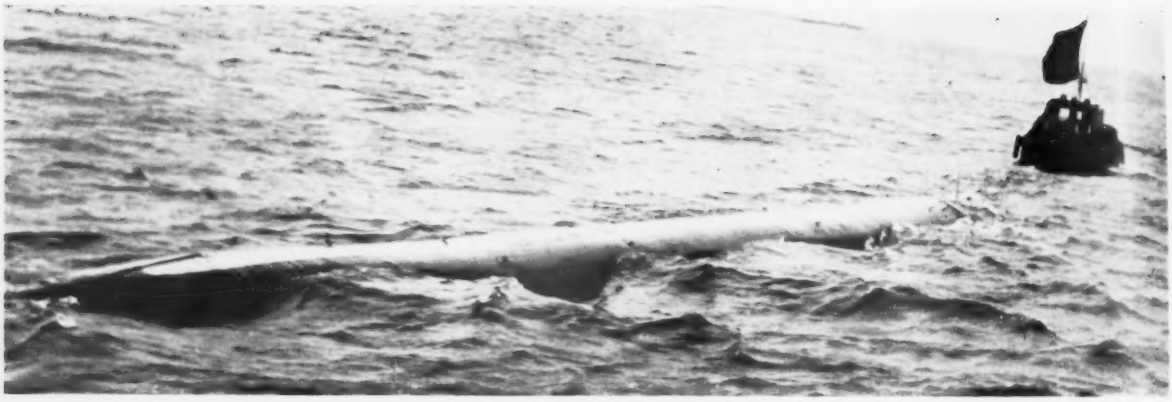


Fig 9. Comparision of stabilities to irradiation of hydrocarbon mineral oils and commercially available silicone fluids

★ ★ ★

ANTARCTICA COMES TO THE IP

At the Council Dinner on 1 October the guests included Sir Vivian Fuchs, M.A., Ph.D., leader of the Trans-Antarctic Expedition, seen above (centre) with the president, C. M. Vignoles, C.B.E. (left) and David Pratt, chief engineer to the Expedition and part author of the paper read to the Institute previously that evening.



Dracone No 1 under test in Southampton Water

The Flexible Oil Barge

Development of the Dracone

An interesting demonstration of the "Dracone" flexible barge has recently been carried out in Southampton to show the capabilities of this new British development. This vessel appears to have considerable possibilities for the carriage and storage of oil or other liquids lighter than water, particularly on inland waterways, in estuarial waters, or in coastal areas.

The Dracone No. 1 under test was 5 feet in diameter, 100 feet in length, and contained 10,400 gallons (about 37 tons) of kerosine. During the demonstration it was towed by a 60 hp diesel launch at speeds up to 5½ knots. A series of turning movements were carried out and it was noted that the barge followed closely the path of the towing vessel, thus indicating its manoeuvrability.

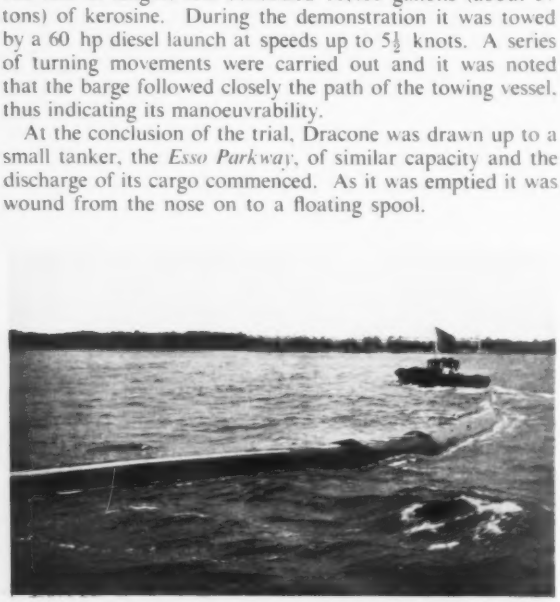
At the conclusion of the trial, Dracone was drawn up to a small tanker, the *Esso Parkway*, of similar capacity and the discharge of its cargo commenced. As it was emptied it was wound from the nose on to a floating spool.

Preliminary Development

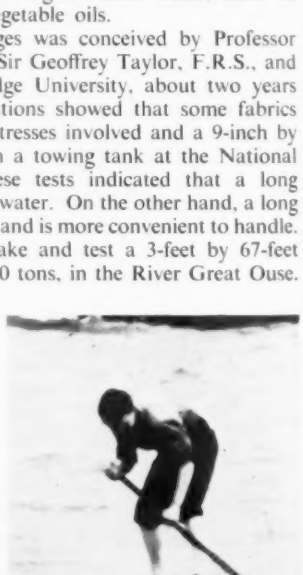
Dracones can correctly be described as flexible towing containers and are claimed to be eminently suitable for the transport by water of fluids lighter than water, such as petroleum, chemicals, or vegetable oils.

The idea of flexible barges was conceived by Professor W. R. Hawthorne, F.R.S., Sir Geoffrey Taylor, F.R.S., and J. C. S. Shaw, of Cambridge University, about two years ago. Theoretical considerations showed that some fabrics could withstand the static stresses involved and a 9-inch by 16-foot model was tested in a towing tank at the National Physical Laboratory. These tests indicated that a long Dracone might snake in the water. On the other hand, a long barge has lower skin stresses and is more convenient to handle.

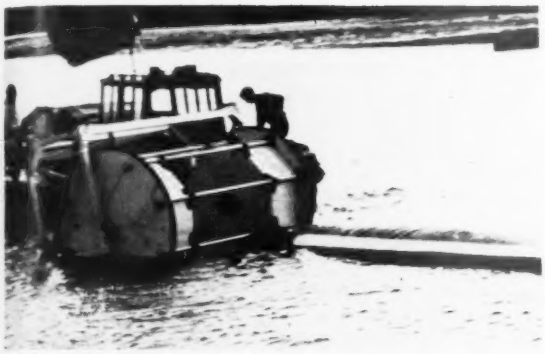
The next step was to make and test a 3-feet by 67-feet model, with a capacity of 10 tons, in the River Great Ouse.



The flexible barge takes a curve without trouble



A demonstration of stability during towing



As the cargo is discharged the Dracone was reeled on to a floating spool while—

Good results were obtained and this model was then tested in Harwich Harbour and in the North Sea under varying conditions up to a gale. During these tests the prevention of yawing and snaking was studied and a satisfactory device developed. This device enabled the barge to be towed straight with only a small increase in drag. It was also found that the model could turn in less than its own length by allowing a fold to form and travel from end to end. Tests showed that the model could ram a river bank at a speed of 5 feet per second without harm, the shock being transferred to the fluid.

Dracone No. 1

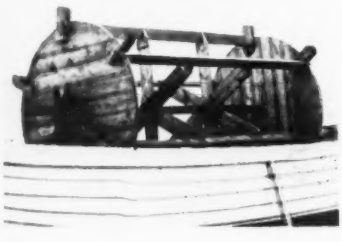
Further experiments and investigations led to the construction of Dracone No. 1, the first operational model, which was used during the demonstration.

For this barge a stressed skin construction has been used, the skin being 5/32-inch thick and consisting of a woven nylon fabric coated on both sides with synthetic rubber. Total weight is 2300 lb, the nylon weighing just over 200 lb. This quantity of nylon gives high mechanical strength, and the rubber seals the fabric and provides abrasion resistance. At nose and stern, eyes are fitted for towing and mooring ropes, for buoys, and for floats carrying flags or navigation lights.

At the stern a 4-inch Avery-Hardoll self-sealing, quick-acting hose connexion is provided for filling and emptying. A connexion for measuring internal pressure is also provided. A stabilizing device is attached to the stern.

Transport of Dracone

As the Dracone is emptied it is gradually wound from the nose end on to a spool. This spool may be of any convenient size and of any available material For example, it may be of metal or wood, and on floats or in a boat. Alternatively, the Dracone can be reeled on to the spool when empty and can be transferred from reel to reel. When on the spool it can be readily transported by train, lorry, or boat. It can also be folded and crated for long journeys or for carriage by air.

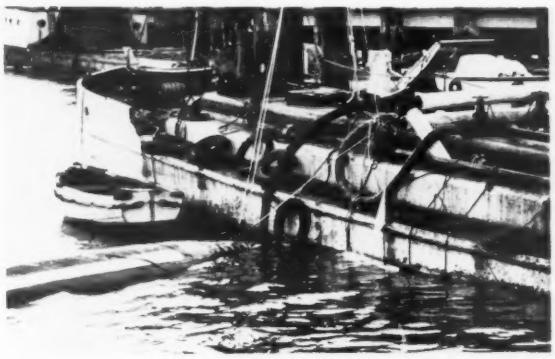


No special design or construction of spool is necessary. This one is mounted in a boat

Future Development

While the original idea was for the large scale ocean transport of oil, it is considered by the company formed to develop the flexible barge that there is considerable scope for its use in the transport of many liquids. The 40-ton barge is regarded as a preliminary to larger vessels, although relatively small barges will be suitable for transport on inland waterways. Some details provided by Dracone Developments Ltd are:

—at the other end a hose was connected and the oil taken into a small tanker



Diameter, ft	5	10	15
Length, ft	100	200	300
Capacity:			
Imp. gals.	10,000	75,000	270,000
Tons (at 0·85 sp gr) ...	40	300	1,100
Draught:			
Max, ft	4	8	12
Normal, ft	3·5	7	10·5
Max economical speed, knots	7	10	12
Drag at max economical speed, lb	800	6,000	19,000
Drag at 7 knots, lb ...	800	2,000	3,500
Empty weight, tons ...	1	4	8

Preparations are in hand for operational trials in inland waterways in the U.K. and abroad and a second 40-ton barge is under construction. Sea trials are also to be made. A manufacturing schedule for Dracones of this size has also been prepared, as also have materials and designs for the 300-ton model.

The advantages claimed for Dracones include their ease of storage and transport in case of emergency. An important aspect is that as there is no air space in contact with the cargo, there need be no explosive air-gas mixture. Ease of transport also permits high utilization rates. It is also suggested that Dracones could be used for temporary storage at such locations as remote drilling sites, etc.

The Company has the support and financial backing of the National Research and Development Council.

*Wrought Steels for the Petroleum Industry**

By S. BARRACLOUGH†

The importance of steel to the petroleum industry needs little emphasis and the awareness of the steel makers, the manufacturers of equipment, and the producers of petroleum products of their mutual interests is shown by the joint efforts made during recent years to provide specifications for steel equipment suitable for the industry. Two factors made this standardization, carried out under the aegis of the British Standards Institution, especially necessary. These were (1) the international character of the oil industry and (2) the predominance, until recently, of plant of American origin, both of which made it imperative for equipment from different sources to be freely interchangeable in all parts of the world.

The petroleum industry uses an exceptionally wide range of steels, some of which have to withstand exacting service conditions involving resistance to high temperatures, to high pressures, to corrosion, etc., and it may, therefore, be convenient to divide the steels to be discussed in this general survey into three broad groups, namely:

1. Low and medium carbon steels.
2. Low alloy steels.
3. High alloy steels.

Carbon Steels

The many varied and useful properties for specific purposes conferred on steel by the addition of alloy elements create an interest in alloy steels which tends to overshadow the importance of carbon steels, but it must not be forgotten that by far the greatest tonnage of steel used in the oil industry, and indeed in other industries, is mild steel, *i.e.* steel of relatively low carbon content. Neither must it be overlooked that the simple description of a material as "mild steel" or "a 20 carbon steel" does not always sufficiently define a steel for an assessment to be made of its suitability for certain purposes. Both for some fabrication processes and for some conditions of service the deliberately controlled procedure employed in making the steel can lead to marked differences in the ease of fabrication and the ultimate serviceability of the product.

Large tonnages of mild steel of the type commonly described as structural steel, with tensile strengths within the range of 24-36 tons per sq. in., as specified in BS 13, 15, 1501, and 1633, are used in the form of plates, sections, and bars, not only for plant buildings but also for structures such as derricks, towers, storage tanks, boilers, etc. For tensile strengths higher than those mentioned, there is the group of high tensile structural steels, many of which have a manganese content of about 1½ per cent, compared with about 0·6 per cent manganese in the ordinary steels, and in some cases a copper content of about 0·35 per cent is included for increasing to some extent the resistance to atmospheric corrosion. These steels comply with BS 548 which, being for riveted structures, permits a carbon content up to 0·30 per cent and specifies a tensile strength of 37-43 tons per sq. in. for all sizes, and with BS 968, which is for welded structures, and which therefore specifies the carbon at 0·23 per cent max, and a tensile strength of 37-43 tons per sq. in. for small sizes decreasing to 33-39 tons per sq. in. for larger sizes.

Mention may also be made of two other high tensile structural steels, namely: *Cor-Ten* and *Fortiweld*. The former, containing about 0·12 per cent carbon, 0·3 per cent manganese, 0·7 per cent silicon, 0·12 per cent phosphorus, 1·0 per cent chromium, 0·4 per cent copper, not only has high tensile strength but an improved measure of corrosion resistance. The latter, a comparatively recent development by the United Steel Companies, is a low carbon steel, *i.e.* approximately 0·12 per cent, with ½ per cent molybdenum and a minute amount of boron. The addition to steel of small amounts of boron of the order of 0·003 per cent has been practised in the United States for some years, but in that case the addition was made to steels of medium carbon content which were to be hardened and tempered, the objective being to eliminate or reduce the amount of alloying elements, such as nickel, chromium, and molybdenum, as a result of the increased hardenability conferred by the minute boron content. In *Fortiweld* the case is different, since the carbon is low and the improved properties are realized in the hot rolled or normalized conditions. The tests in Table I show that the improvement in properties is not obtained by either molybdenum or boron alone but that together a tensile strength of about 40 tons per sq. in. and a yield ratio of about 75 per cent are obtained, accompanied by good ductility and shock resistance.

TABLE I

	1	2	3	4
Carbon	0·09	0·09	0·08	0·08
Manganese ...	0·42	0·43	0·41	0·40
Molybdenum ...	—	0·58	—	0·58
Boron	—	—	0·003	0·003
Tensile strength	26·5	28·5	25·8	41·0
Yield stress ...	18·7	16·2	17·1	34·8
Elongation ...	44	40	41	26
Izod	94	99	96	93

These results show that the tensile strength is increased by about 50 per cent and the yield stress by about 100 per cent and, as would be expected from steel of such low carbon content, but unlike steels of similar tensile strength, *Fortiweld* may be satisfactorily welded without special precautions.

*Read at a meeting of the IP Stanlow Branch on 20 November 1957.

†The United Steel Companies Ltd Research & Development Department, Swinden Laboratories, Moorgate, Rotherham.

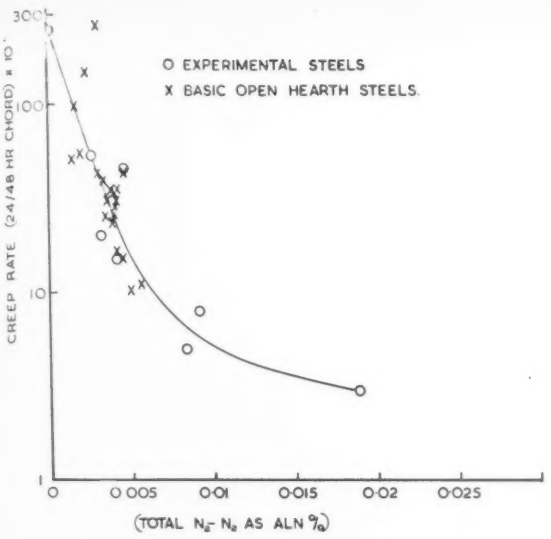


Fig 1. *The creep resistance of carbon steel test conditions:— 8·0 tons/sq. inch at 450° C.*

Extensive investigations on the decrease in notch ductility, as measured by an impact test, with decrease in temperature, has led to the development of structural steels which have guaranteed impact values when subjected to a Charpy-V notch test at temperatures ranging from 0° C for ND. I grade to −50° C for ND. IV grade. These results are obtained from steel of a carefully limited composition produced by a carefully controlled steel-making technique. Steels of this type are at present covered by BS 2762 but the preparation of a specification for steels of this type for the petroleum industry is in hand.

Thousands of tons of carbon steel are used for many of the miles and miles of pipes and tubes used by the industry, much of this operating at normal temperatures. In some cases, however, mild steel is also used in equipment working at higher temperatures, though, owing to the limitations imposed by scaling and by decline in mechanical properties with increasing temperature, the maximum working temperature for an unalloyed steel is usually about 450° C.

Mention has already been made that the chemical composition as normally understood does not necessarily establish suitability in service, and this is particularly well exemplified by mild steel for high temperature duty. The mechanical properties of steel, as determined by a tensile test at ordinary temperatures, are no criterion of the load carrying capacity at higher temperatures, since steel, when stressed at temperatures above about 300° C, deforms or creeps continuously, even though the stress is below the elastic limit. A number of years ago, it was noted that steels of similar nominal composition and tensile strength gave markedly different results when tested under creep conditions. While some steels had a low creep rate, others showed a high rate of creep and to these latter the rather unfortunate designation of abnormal steels was applied. Investigations showed that steels which had been deoxidized with silicon had generally good creep properties but those killed with aluminium, as was the practice for steels to be made into superheater tubes, showed marked variations in creep resistance. As the addition of aluminium to the molten steel influences the grain size, producing what is known as fine grain steel, it was at first thought that the grain size might prove an index of the creep resistance but, whilst coarse grain steel had a low creep rate and fine grain steel had nearly always an inferior creep rate, steel of mixed grain size showed very variable properties. Extensive investigation has, however, fairly well established that, on the basis of the short time test defined in BS 1271, 1½-2 lb of aluminium per ton of molten steel may be added without detrimental effect on the creep properties. The mechanism whereby the creep properties are effected has also been clarified and, although it was at first suggested that creep properties deteriorated with increasing content of aluminium nitride, it has now been shown that this effect is only an indirect one due to the removal by the aluminium of nitrogen from solution and that there is a clearly defined relationship between creep rate and nitrogen in solution. This is illustrated in Fig 1. Thus, provided the total nitrogen content is sufficiently high to leave sufficient in solid solution, steels deoxidized with a carefully controlled amount of aluminium to produce the fine grain desirable for the fabrication of tubes and which also possess satisfactory creep properties can be made.

Carbon steel pipes and tubes for oil industry service are covered by BS 1601, 1602, 1603, 1604, 1627, and 1730.

Low Alloy Steels

Strengths higher than those mentioned for mild steel may be obtained both by increasing the carbon content and by heat treating, *i.e.* by hardening and tempering, but the extent to which the tensile strength may be increased is limited by two factors, *namely*: (1) the increasing brittleness and loss of ductility as the carbon increases and (2) carbon steels can only be fully hardened in relatively small sections. The critical cooling velocity of a carbon steel, *i.e.* the minimum cooling speed which will produce satisfactory hardening, is high but the addition of alloying elements, *e.g.* manganese, nickel, chromium, molybdenum, reduces this rate to an extent depending on the particular

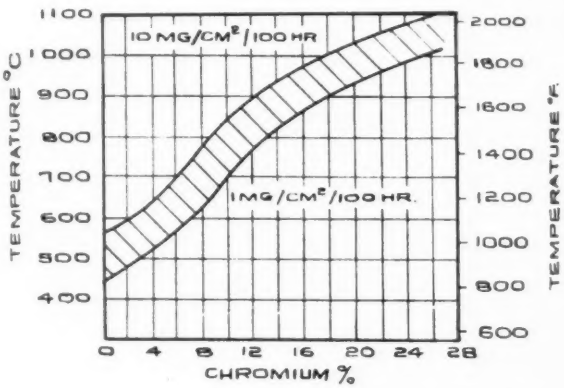


Fig 2. *The effect of increasing chromium content on oxidation resistance of steel.* (*Taken from Uhlig Corrosion Handbook*)

TABLE II

LIMITS OF RULING SECTION WITHIN WHICH THE TENSILE STRENGTHS SPECIFIED ARE OBTAINABLE

No.	Type of Steel	Approximate Composition					Ranges of Tensile Strength, tons per sq. in.						
		C.	Mn.	Ni.	Cr.	Mo.	45/55	50/60	55/65	60/70	65/75	70/80	100 min.
En. 15	1½% manganese	0·35	1·5	—	—	—	2½"	1"	—	—	—	—	—
En. 18	1% chromium	0·40	0·80	—	1·0	—	4"	2½"	1⅛"	—	—	—	—
En. 16	Manganese-molybdenum ...	0·35	1·5	—	—	0·30	6"	4"	2½"	1⅛"	1"	—	—
En. 100	Manganese-nickel-chromium-molybdenum	0·40	1·3	0·75	0·45	0·20	6"	4"	2½"	1⅛"	1⅛"	—	—
En. 19A	1% chromium-molybdenum	0·40	0·70	—	1·1	0·30	6"	4"	2½"	1⅛"	1"	—	—
En. 22	3½% nickel	0·40	0·70	3·5	—	—	—	4"	2½"	—	—	—	—
En. 111	1¼% nickel, ½% chromium ...	0·35	0·70	1·25	0·6	—	6"	4"	2½"	1⅛"	—	—	—
En. 17	Manganese-molybdenum ... (higher molybdenum)	0·35	1·5	—	—	0·45	6"	6"	4"	2½"	1⅛"	—	—
En. 110	1½% nickel, 1¼% chromium (low molybdenum)	0·40	0·60	1·4	1·2	0·15	6"	6"	4"	2½"	1⅛"	—	—
En. 23	3% nickel, ¾% chromium ...	0·30	0·60	3·0	0·75	—	—	6"	6"	6"	2½"	—	—
En. 24	1½% nickel, 1¼% chromium molybdenum	0·40	0·60	1·5	1·2	0·25	—	6"	6"	4"	2½"	1⅛"	1⅛"
En. 25	2½% nickel, ¾% chromium molybdenum (med. carbon)	0·32	0·60	2·5	0·7	0·55	—	—	6"	6"	6"	4"	2½"
En. 26	2½% nickel, ¾% chromium molybdenum (high carbon)	0·40	0·60	2·5	0·7	0·55	—	—	—	6"	6"	6"	4"
En. 30A	4¼% nickel, 1¼% chromium	0·30	0·50	4·1	1·2	—	—	—	—	—	—	—	2½"* 6"†
En. 30B	4¼% nickel, 1¼% chromium molybdenum	0·30	0·50	4·1	1·2	0·30	—	—	—	—	—	—	

*if air hardened. †if oil hardened.

element or elements and the amount added. Thus the addition of alloying elements enables complete hardening to be obtained in sections larger than would be the case with carbon steel, and in many instances allows a reduction in the severity of the quenching operation by oil quenching or even by air cooling instead of water quenching. It is not possible in a short space to detail the many steels with varying combinations of alloying elements which have been evolved to provide tensile strengths ranging from 45 to 100 tons per sq. in., but a general picture of the relation of the size of the part at the time of heat treatment, expressed as diameter of bar, to the different tensile ranges of the common alloy steels used in the hardened and tempered condition is shown in Table II.

It will be seen that for a particular strength range, the steel should be more highly alloyed as the size of the part at the time of heat treatment increases or conversely for a particular steel, the ruling section decreases when higher tensile strength is required. All the steels, with the exception of those containing 4¼ per cent nickel and 1¼ per cent chromium, require oil quenching but, with these amounts of alloying elements present, the critical cooling rate is so reduced that bars up to 2½ inch may be hardened by air cooling, though larger sizes need to be oil quenched.

In steels for case hardening similar considerations apply and, while a carbon steel will be used where only a low core strength is required, steels containing gradually increasing amounts of alloying elements are necessary for higher core strengths as shown in Table III.

Of the low alloy steels, the 3-3½ per cent nickel steel when produced as a fine grain steel, is used where guaranteed impact properties are required at sub-zero temperatures, *e.g.* —100 C. If the steel is to be hardened and tempered, the steel is of higher carbon type, *e.g.* about 0·35 per cent, but if only normalizing and tempering is to be employed, the lower carbon steel, *e.g.* about 0·12 per cent is used.

In the selection of low alloy steels for high temperature service, at least two conditions have to be considered, viz: adequate strength under creep conditions and resistance to scaling. Molybdenum is the main element conferring enhanced creep properties, as is shown by the following types of creep resisting steels: (a) ½ per cent molybdenum, (b) 1 per cent chromium, ½ per cent molybdenum, (c) 2¼ per cent chromium, 1 per cent molybdenum, whilst resistance to scaling is obtained mainly by the addition of chromium. The beneficial effect of chromium in promoting resistance to scaling can be gauged from the curve shown in Fig 2, which is based on the gains in weight after 100 hours heating in air at different temperatures plotted

against chromium content. On the other hand, chromium does not improve the creep strength characteristics. As will be seen from Fig 3, although the addition of chromium up to about 1½ per cent confers a slight improvement, higher chromium contents produce a rapid drop in creep strength so that the choice of the most suitable steel may have to be a compromise involving a balance between creep properties and scale resistance as well as taking into account the mechanical properties at normal temperatures, in many cases resistance to chemical attack in service and any fabrication problems which may arise.

To meet these varied and sometimes conflicting requirements, a number of steels have been developed suitable for the production of pipes and tubes, of plates and sections, and forgings. The common feature of all these steels is a molybdenum content of at least ½ per cent, and in the steels for pipes and tubes the carbon content is of the order of 0·10 to 0·15 per cent, while for plates and forgings the carbon tends to be higher at 0·20 to 0·30 per cent. Except in the case of the carbon-molybdenum steel, chromium is also present at the approximate levels of 1 per cent, 2¼ per cent, 3 per cent, and 5 per cent. The heat treatment given to these steels is usually the simple one of annealing or normalizing for the lower carbon steels and normalizing and tempering for the higher carbon contents.

Specification for these steels are included in a number of British Standards, *e.g.* 1507, 1508, 1605, 1606, 1607, 1730, 1731, for pipes and tubes, and 1501, 1503, and 1506 for plates, sections, bars, and forgings.

Owing to the numerous variables, such as the intensity of the stresses imposed, the permissible amount of creep, the severity of the conditions producing scaling, and the liability to corrosive attack, it is not possible to lay down hard and fast rules for the application of the different steels. Broadly speaking, the ½ per cent molybdenum steel may be used up to about 480°C, although owing to this steel being rather deficient in ductility under certain conditions of stressing, there is a trend to replace this steel with the 1 per cent chromium, ½ per cent molybdenum steel which can be employed for temperatures of the order of 525°C, while the 2¼ per cent chromium, 1 per cent molybdenum, besides being somewhat more corrosion resistant, can be used for metal temperatures of 600°C. The higher chromium contents of 3 and 5 per cent are useful where resistance to corrosive attack is involved, *e.g.* at high temperatures and pressures hydrogen seriously impairs the properties of many steels but chromium imparts resistance to this deterioration and with 3 and 5 per cent chromium there is substantial resistance to hydrogen attack at temperatures up to 500°C and pressures up to 350 atmospheres, and a considerable measure of resistance to attack by sulphur-bearing compounds is also conferred by a medium chromium content. The higher chromium content of 5 per cent makes the steel markedly air hardening, but this tendency may be minimized by neutralizing or stabilizing the carbon present by the addition of either titanium or niobium.

For high temperature bolts, where tensile strengths of the order of 55-65 tons per sq. in. are normally required, the steel must be capable of being hardened and tempered to the required strength. For many years a steel containing about 0·40 per cent carbon, 1¼ per cent chromium, 0·60 per cent molybdenum, as used for type 7A bolting, *i.e.* of the BS 1506-621 Grade B type, often also referred to as En 20B type, has given excellent service at temperatures up to about 480°C. Stemming from this there have been introduced other steels for service at higher temperatures, such as (1) that of similar composition with the addition of about 0·25 per cent vanadium which is suitable for temperatures up to 510°C, and (2) that containing about 0·20 per cent carbon, 1 per cent chromium, 1 per cent molybdenum, 0·7 per cent vanadium, which is capable of operating at metal temperatures up to 560°C. Some steels when maintained for prolonged periods at the temperatures under consideration, particularly if under conditions of stress, tend to embrittle, *i.e.* the toughness as measured by a notched impact test is seriously reduced, but steels of this type are relatively free from this trouble. At the other end of the scale, the 1 per cent chromium, ½ per cent molybdenum, has also proved very satisfactory for service at temperatures of −100°C.

High Alloy Steels

The high alloy steel group is characterized by high contents of both chromium and nickel and the steels possess high resistance to scaling and chemical attack and good creep resisting properties. These steels, commonly referred to as the austenitic steels, *i.e.* they consist of a single phase, are essentially non-magnetic and cannot be hardened by heat treatment, in fact they are softened by rapid cooling. The basis steel of the group is one containing 18 per cent chromium, 8 per cent nickel, with a low carbon content, *e.g.* 0·12 per cent. Such a steel can be readily welded but will then require re-softening from a temperature of 950°-1000°C, otherwise under many corrosive conditions serious attack can occur adjacent to the weld. This condition, which can be simulated without welding by heating in the temperature range 500°-850°C, particularly at 650°C, is due to the precipitation at the grain boundaries of chromium carbides, which impoverishes the adjacent areas of chromium and hence reduces the corrosion resistance. The lower the carbon the

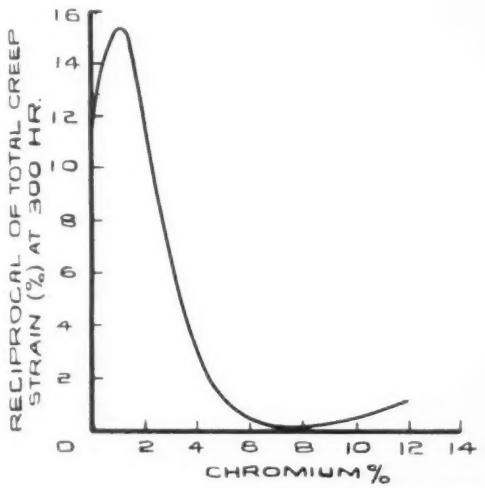


Fig 3. The effect of chromium on forged 0·2 per cent C, 0·5 per cent Mo, 0·5 per cent W, 0·8 per cent steel. 8 tons sq. inch at 600°C.

TABLE III

CASE HARDENING STEELS

No.	Type of Steel	Approximate Composition					Minimum tensile strength of core, tons/sq. in.
		C.	Mn.	Ni.	Cr.	Mo.	
En. 32A & B.	Carbon	0·15	0·7	—	—	—	32
En. 33	3% nickel	0·1₅	0·5	3·0	—	—	45
En. 34	2% nickel-molybdenum	0·1₅	0·5	1·5	—	0·25	45
En. 351	1% nickel-chromium ...	0·18	0·6	0·6	0·6	—	45
En. 361	"15" C low alloy ...	0·15	0·6	0·6	0·7	0·12	45
En. 36T	3% nickel-chromium ...	0·10	0·5	3·2	0·9	—	55
En. 325	Nickel-chromium-molybdenum	0·20	0·5	1·8	0·5	0·25	55
En. 352	1% nickel-chromium ...	0·20	0·8	1·0	0·8	—	55
En. 362	"20" C low alloy ...	0·20	0·8	0·6	0·7	0·12	55
En. 36V	3% nickel-chromium ...	0·14	0·5	3·2	0·9	—	65
En. 353	1¼% nickel-chromium ...	0·20	0·8	1·2	1·0	—	65
En. 363	"25" C low alloy ...	0·25	0·8	0·6	0·7	0·12	65
En. 354	1¼% nickel-chromium-molybdenum	0·20	0·8	1·8	1·0	0·15	75
En. 39A	4¼% nickel-chromium ...	0·16	0·4	4·2	1·2	—	85
En. 39B	4¼% nickel-chromium-molybdenum	0·16	0·4	4·2	1·2	0·25	85
En. 355	2% nickel-chromium-molybdenum	0·18	0·5	2·0	1·6	0·20	85

less the susceptibility to this type of attack, but to ensure immunity under all conditions would require a carbon content of less than 0·03 per cent. Therefore, the common remedy is to add an element such as titanium or niobium, which by combining with the carbon prevents chromium impoverishment. The minimum amounts of titanium and niobium required are respectively four and eight times the carbon content.

Steel of the 18/8 type stabilized with titanium is widely used where good corrosion resistance is necessary and the steel is also useful for high temperature applications up to temperatures of about 850° C. The amounts of 18 per cent chromium and 8 per cent nickel produce a condition which is just, but only just, austenitic and which on work hardening, gradually becomes magnetic. By increasing the nickel to 12 per cent a more stable structure is obtained which is more responsive to some manipulative processes and, therefore, a steel containing 18 per cent chromium, 12 per cent nickel, 1 per cent niobium, has also been introduced.

Although contents of 18 per cent chromium and 8 per cent nickel confer resistance to chemical attack under many service conditions, the corrosion resistance to some chemicals, *e.g.* certain concentrations of sulphuric acid, may be improved by the addition of about 3 per cent molybdenum. The presence of this molybdenum confers a considerable measure of immunity to weld decay, and for some conditions no addition of stabilizer is made, but sometimes it is safer, if not essential, to add titanium or niobium.

Although the 18/8 steels consist of the single constituent, austenite, the addition of titanium, niobium, and molybdenum modifies this structure, so that a second constituent known as ferrite, is present, and it has been found that steels with this duplex structure, when heated at temperatures of about 800° C, can undergo a change which results in the formation of a third constituent known as sigma phase. This constituent is brittle, so that its formation may reduce the shock resistance and consideration has consequently to be given to the composition of high chromium nickel steels to ensure that the sigma constituent is not formed under service conditions in amounts which would seriously affect the properties of the material. In the molybdenum-bearing steel, at any rate where high temperature duty is involved, the molybdenum is usually limited to a maximum of 3 per cent and the chromium to a maximum of 18 per cent, while the nickel is increased to 10 per cent or more. These considerations of the high temperature stability of the 18/8 and 18/8/molybdenum steels are adequately provided for in BS 1501, 1503, 1506, 1607, and 1750. The 18/8 chromium-nickel steels are also used for low temperature service down to temperatures of −190° C.

In addition to the steels mentioned there are many others with varying combinations of chromium and nickel, with or without the addition of other elements, each of which has its own particular advantages for certain applications. Of these the most common is that containing 25 per cent chromium with 16 to 20 per cent nickel which, combined with reasonable strength at elevated temperature, has excellent scale resistance up to 1150° C.

Conclusion

In this review of the wide range of steels necessary for the exacting requirements of the petroleum industry, it has been possible to refer only to those which have sufficiently proved their worth to justify recognition as standard types and to mention only the more important characteristics of any particular steel. The incorporation of such steels in national standards facilitates the production and supply of material of proved quality and performance to the mutual advantage of supplier and consumer and also eases the problem of interchangeability of material and equipment from different sources. At the same time, it must not be overlooked that investigations are always in progress to develop steels with enhanced properties and that advances, especially in the field of steels for high temperature duties, are continuously being achieved.

* * *

MR VIGNOLES URGES FUEL EFFICIENCY

Urging manufacturers to make the most efficient use of fuel in industry, C. M. Vignoles (managing director of Shell-Mex and B.P. Ltd) said at the opening of the Industrial Fuel Efficiency Exhibition at Olympia, London, that the lessons of the past twenty years had brought governments, the leaders of the fuel industries, and an ever-widening circle of industrialists to realize that the national interest will always demand thrift and good husbandry in our use of the raw materials of power.

He went on to remark that at present it happens that a combination of unusual circumstances had produced a surplus of some kinds of fuel. The rate of growth in industrial activity would, however, accelerate again and demand for all kinds of fuels would again present a challenge to supplier and consumer alike.

In conclusion Mr Vignoles said that the neglect of fuel efficiency, as a neglect of any opportunity to make a saving in business, would be accepted by most people as sheer bad management, for the practice of fuel efficiency was an important contribution to increased productivity.

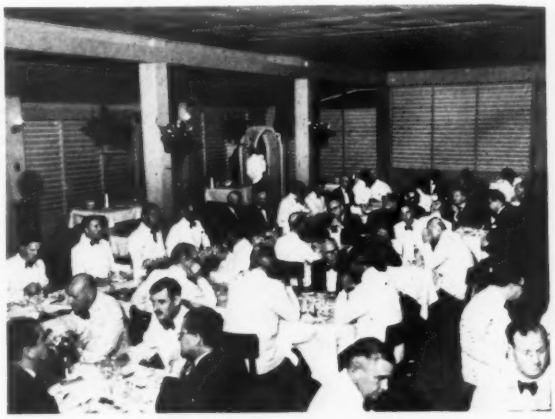
Around the Branches

BAHRAIN, ESSEX, FAWLEY, KUWAIT, LONDON, NORTHERN, SCOTTISH, SOUTH-EASTERN, SOUTH WALES, STANLOW, TRINIDAD

Trinidad Branch Dinner

The 20th Annual Dinner of the Trinidad Branch of the Institute of Petroleum was held at the Bretton Hall Hotel, Port of Spain, on 17 May, and the Branch chairman, Dr K. W. Barr, presided. The guest of honour was His Excellency the Governor of Trinidad and Tobago, Sir Edward Betham Beetham and other guests of the Branch included the Hon. John O'Halloran, Minister of Industry, Commerce, Tourism, and External Communications, I. Moreland-Hopkins, Director of Education, and Dr W. G. C. Forsyth, Director of the Colonial Microbiological Research Institute. Among the 60 members of the Branch who attended the dinner were P. E. T. O'Connor, one of the founder members, and the General Managers of the majority of the oil companies operating in Trinidad. With the guests of members, the total attending the dinner was 125.

After the Loyal Toast, proposed by Dr Barr, I. Moreland-Hopkins proposed the toast of the Institute, making special reference to the role of not only the Institute but also the oil companies in the furtherance of education and particularly technical education in Trinidad. Dr Barr, the Chief Geologist of Texaco Trinidad, Inc., in his chairman's address, dealt briefly with the activities of the Institute during the previous year and then outlined the role of the geologist in the community. In addition to the part that the geologist played in the search and location of petroleum, he mentioned a number of other fields of endeavour in Trinidad in which the geologist played an important part, water supply, roads, and all major engineering projects. Dr Barr concluded by making reference to the opportunities for young men taking up geology as a profession, particularly active men who still had the urge to tramp the countryside, hammer in hand.



Trinidad Annual Dinner

R. W. Lucie-Smith proposed the toast to the guests and T. V. Haines, the Principal of Queens Royal College, replied.

H.E. the Governor took the opportunity of thanking the Branch for their hospitality and stressing the need for the young men of the Colony to fit themselves for the practical jobs that were available in the oil industry.

The Branch held four meetings in the first half of 1958, attendances at which were the highest yet recorded.

At the Apex Club House, in February, A. W. Buckley read a paper on "Gas Lift", whilst in June, Dr W. G. C. Forsyth gave an account of the work being carried out by the Colonial Microbiological Research Laboratory in Trinidad, of which he is director. In March, a meeting was held at the Clifton Hill Club at Point Fortin when J. H. Besijn read a paper entitled "Marine Drilling

His Excellency arriving at the Dinner, escorted by Dr K. W. Barr, with the Governor's A.D.C. Major Hargreaves, and the Branch Secretary S. Howe

Left to right: *P. L. May, A. S. Curlet, A. Macrae, Dr W. G. C. Forsyth, J. Cunningham*

Floating-Bases". At the end of May, Dr A. L. Down gave an account of catalytic reforming with particular reference to the new reforming unit which had just been completed at Pointe-a-Pierre and on a following Saturday afternoon the Branch paid a visit to this unit.

In the sporting field, the golf match for the Godfrey Golf Trophy was played at Point Fortin and won by Mr Sedgeley of Shell (Trinidad) Ltd.

London Branch

For their opening meeting of the 1958–59 Session on 22 September, the London Branch had a record gathering for a September meeting. The total attendance of about 120 members and visitors was almost a record for any meeting of the Branch.

The reason for this large attendance was no doubt due to the subject of the paper and the standing of the author. The subject was Soviet Satellites and the author was O. K. Sapounov, C.D., a second secretary at the U.S.S.R. Embassy in London. Mr Sapounov who had an excellent command of the English language dealt with various aspects of earth satellites tracing the history of rockets back to the end of the last century. Referring to early work in the Soviet Union he mentioned that in 1936 a rocket engine was tested which had a variable thrust of 110–390 lb and its fuel was kerosine and nitric acid. Mr Sapounov then turned his attention to the three sputniks which had been launched into their orbits by the Soviet Union and by means of lantern slides showed details of instrumentation and other features of these satellites. Concluding Mr Sapounov said that the main problems which are being solved by the use of earth satellites were concerned with the structure of the earth, research on the atmosphere, and research on space problems. Precise measurements of the sputnik orbits would give data concerning the earth's form, the distribution of its mass, and its magnetism. It would also give data for long term weather forecasts. The main problem of space research was the study of cosmic rays and their origin and the solution of these problems would cast light on the origin of the Universe. Space research would also pave the way to interplanetary flights and already the Soviet sputniks had made a valuable contribution in this field. A lot of problems were still to be solved before an unmanned flight to some remote planets could be made.

At the conclusion of the meeting Mr Sapounov answered numerous questions and was accorded a hearty vote of thanks for his paper.

Bahrain Branch

On 4 August a large number of members and guests attended the Branch film show to see the *Conquest of Everest*. The film was introduced by G. Tod, acting general manager of the Qatar Petroleum Co. Ltd, himself a member of the Alpine Club, with a general explanation of some climbing techniques and a demonstration of the various equipment used in mountaineering.

Mr Tod gave three basic essentials for mountaineering: first it must be an exercise in harmony and rhythm, secondly there must be no fear whatever, and finally it must be a safe exercise so that the returning mountaineer is happy and comfortable.

Mr. Tod's introduction and explanation of techniques helped to set the atmosphere for the evening and contributed considerably to the success of the film show.

On 18 August in the P.C.L. Guest House, Manama a talk was given by J. F. Luttrell, public relations officer of the Qatar Petroleum Co. Ltd, entitled "Oil and the Community". It was said that after the producing and marketing of oil the second most important task of an oil company should be to establish and maintain good relations with the community.

J. F. Luttrell

Remarking that good relations between an oil company and the community were based, not on a handful of specialists but on the broad mass of employees, Mr Luttrell went on to enumerate some of the means by which these good relations are formed.

Then followed the showing of the film *Rivers of Time*, made by the Iraq Petroleum Co. Film Unit, and which showed the birth of civilization between the rivers Tigris and Euphrates more than five thousand years ago and the Arab contribution to history.

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MIDDLE EAST OIL PRODUCTION

	August	*Jan.–Aug.*
	Tons	
Iraq Petroleum Co. Ltd ...	2,151,014	14,258,555
Basrah Petroleum Co. Ltd ...	962,283	6,975,626
Mosul Petroleum Co. Ltd ...	111,024	859,852
Qatar Petroleum Co. Ltd ...	665,055	5,315,548
Iraanse Aardolie Exploratie en Productie Mij	3,622,000	26,244,000
Kuwait Oil Co. Ltd	5,775,681	44,869,363
	Barrels	
Arabian American Oil Co. (Saudi Arabia)	30,717,927	242,577,354
Bahrain Petroleum Co. Ltd ...	1,254,966	10,407,014

The refinery throughput at Abadan of the Iraanse Aardolie Raffinage Mij for August was 1,368,000 tons, the total for 1 January to 31 August being 10,136,000 tons.

Crude processed at Aramco's Ras Tanura refinery during August was 4,873,044 brl, the total for 1 January to 31 August 41,831,277 brl.

Oil deliveries from Sidon, Lebanon, by Trans-Arabian Pipe Line Co. in August were 10,747,074 brl, the total for 1 January to 31 August being 87,363,492 brl.

The main depot at Collingtree with a tanker from Coryton refinery unloading

Mobil Fuels and Lubricants on the New Motorway

To supply fuel for 400 and lubricants for 1400 earth-moving vehicles from the largest "Cat" to the smallest hoist without delay to operations—such was the problem which confronted Mobil Oil Company when John Laing and Son Ltd and many of their sub-contractors appointed the Company a supplier for fuels and lubricants during the construction of the 53-mile first section of the new London-Yorkshire Motorway. This section stretches from near Harpenden to Dunchurch, near Rugby, and the first step was to select a strategic site from which to control supplies. A major consideration was that the lubricants were to be supplied over the whole 53 miles of the road, while the fuel contract covered section C of the four such sections.

It was thus decided to establish the main depot at Collingtree, south-east of Northampton, half-way along section C. A small sub-depot, for lubricants only, was established at Charlton Cross, Toddington, in the A section.

Storage capacity at the Collingtree depot consists of two 2000-gallon underground tanks for gasoline, these being connected to a refuelling industrial kerbside pump. For diesel oil for road vehicles, a 2000-gallon overhead tank is provided, and for gas oil for earth-moving equipment in use on the new road, a similar overhead tank of 12,000 gallon capacity has been installed.

There is provision at the depot for fuelling vehicles with gasoline and derv fuel, and a 1200-gallon road tanker makes gasoline deliveries to plant on site. Four other refuelling tankers, used for making deliveries of gas oil on site, are all single-compartment Bedford vehicles with four-wheel-drive. They are fitted with engine-driven pumps to deliver the fuel through two dispensing meters to hoses on booms swinging out from the side of the tanker. Micronic filters are provided in the delivery lines to ensure cleanliness of fuel.

To cater for the wide variety of vehicles and plant requiring lubrication—excavators, bulldozers, mechanical shovels, lorries, hoists—over thirty grades of the Mobil Company's lubricating oils, greases, and hydraulic oils are stocked at the Collingtree Depot. For the distribution of these products, three 3-ton four-wheel-drive lorries are used and also two long-wheelbase Land Rovers. The latter are mainly used for the delivery of small packages to points on the project where no other small vehicle could possibly travel.

Total deliveries of liquid fuels average 5000 to 6000 gallons per day, of which about 4000 or more gallons is gas oil. In addition, supplies of lubricants are anticipated to reach some 140,000 gallons before the road under construction is completed. To ensure that there is no hold-up of work on the road, where operations go on for 23 hours per day, the Mobil depots give constant service from 5 a.m. to 9 p.m.

A Land Rover brings a supply of lubricants

Re-fuelling a Cat from a 950-gallon Bedford tanker

Shell photograph

Comet 4 *in flight—a graceful bird which later was the first jet-propelled passenger machine on the Trans-Atlantic service*

Aviation and Petroleum

The 1958 Farnborough

The petroleum industry and the aircraft industry are both customers of each other and therefore the annual flying display and exhibition of the Society of British Aircraft Constructors is always attractive to the petroleum industry. Farnborough 1958 was no exception and provided another opportunity for supplier and customer on both sides to meet and to exhibit their products.

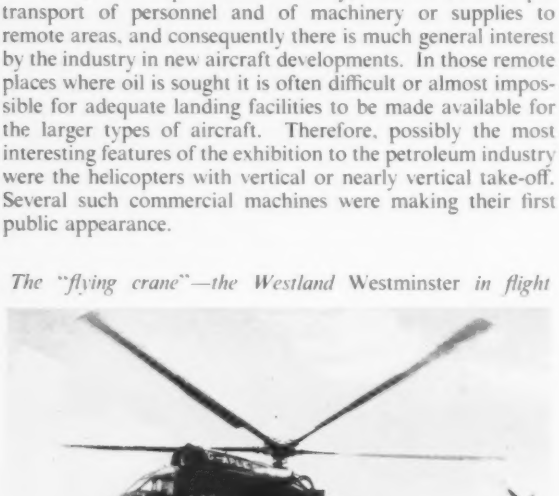
It is not within our field to discuss the merits of various types of aircraft or to go into purely aeronautical features. However, to the petroleum industry, aircraft offers rapid transport of personnel and of machinery or supplies to remote areas, and consequently there is much general interest by the industry in new aircraft developments. In those remote places where oil is sought it is often difficult or almost impossible for adequate landing facilities to be made available for the larger types of aircraft. Therefore, possibly the most interesting features of the exhibition to the petroleum industry were the helicopters with vertical or nearly vertical take-off. Several such commercial machines were making their first public appearance.

The Fairey Rotodyne.—Capable of carrying 40 to 48 passengers or about 15,000 lb freight at a cruising speed of 184 mph over a typical stage length of 230 miles, this machine first flew in November 1957. Its two Napier *Eland* turboprop engines each drive an airscrew and an auxiliary air compressor. The latter supply air to pressure-jet units at the rotor tips. Can be operated as a pure helicopter or as an autogyro. Main rotor diameter is 90 ft; fuselage length, 58 ft 8 inches; fixed wings span, 46 ft 6 inches; height to top of rotor pylon, 22 ft 2 inches; weight loaded, 33,000 lb.

Westland Westminster.—The "Utility" version shown, although primarily for military use, is also suitable for industrial use as a flying crane. Furnished with two Napier *Eland* rear-drive shaft turbines, it can lift in excess of six tons or, in a passenger transport version, can seat 46 persons. Its range is 390 miles and its speed 150 mph. Rotor diameter is 72 feet and fuselage length 70 ft. It first flew in June 1958.

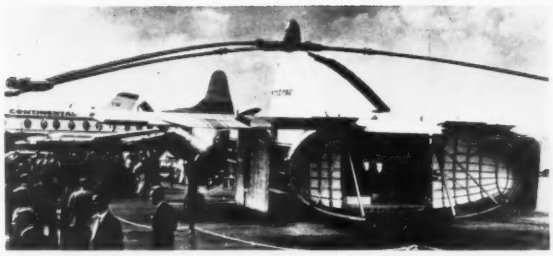
*Saunders-Roe P.*531.—This 5-seat general purpose helicopter first flew in July and has one Blackburn *Turmo* 600 *Series* free-turbine engine. Main rotor diameter is only 32 ft 6 inches; length folded, 29 ft (tail rotor vertical); height 9 ft 6 inches (tail rotor vertical); all-up weight, 3800 lb; max powered speed, 121 mph. First flew in July.

The "flying crane"—the Westland Westminster *in flight*



The Saunders-Roe P.531, *5-seater general purpose helicopter*

Shell photographs



Shell photographs

The world's first VTOL airliner, the Fairey Rotodyne *in the air* (left) *and on the ground with doors open* (above)

Although the accent of the flying display was on Service machines, several new commercial aircraft were seen in the air. Among those making their first appearance in the Display were:

Comet.—Both the de Havilland Comet 4 and 3B versions showed their paces and are as graceful as ever. Since the Display the former successfully completed its proving flights and several are now in operation by BOAC on the Trans-Atlantic service. Both types are powered by four Rolls-Royce *Avon R.A.*29 jet engines.

Jin Alpha.—This machine by Auster Aircraft demonstrated its use as a crop-spraying unit. It can also be used for aerial photography, as a flying ambulance, and a variety of duties. Its engine is a 130 hp de Havilland *Gipsy Major.*

Chipmunk.—Crop-spraying was demonstrated also by this de Havilland machine which can quickly be converted to a freighter. Engine is a de Havilland *Gypsy Major* 10.

Dart Herald.—Built by Handley Page Ltd and powered by two 2100 hp Rolls-Royce *Dart* turboprop engines, it first flew in March. With seating capacity up to 43, it can be converted for passenger-freight or all freight by the use of movable bulkheads.

Equipment

The huge indoor exhibition of equipment and supplies for the aircraft housed over 300 individual stands. In addition there were over 30 exhibits in an outdoor equipment.

A considerable number of IP Member-Companies were represented in these exhibitions, including:

Thomas Boorn & Co. Ltd.
The English Electric Co. Ltd.
Esso Petroleum Co. Ltd.
The General Electric Co. Ltd.
Imperial Chemical Industries Ltd. (Metals, Paints, and Plastics divisions).
Manchester Oil Refinery (Sales) Ltd.
The Mond Nickel Co. Ltd.
The Pyrene Co. Ltd.
Rubery, Owen & Co. Ltd.
Serk Radiators Ltd.
Shell-Mex and B.P. Ltd.
Siebe, Gorman & Co. Ltd.
Zwicky Ltd.

Of special attraction was the stand of Shell-Mex and B.P. on which the BP Aviation Service demonstrated the landing of a spaceship on the moon. A 10-inch flying saucer was seen taking off, travelling across the moon, and landing, all without visible means of support or propulsion. Magnets under the floor set up a field strong enough to support and light the model.

The Esso stand presented an interesting schematic diagram of the main features of the earth's lower and upper atmospheric regions. The heights of the various layers of air were indicated as well as some of the more important chemical, electro-magnetic, and meteorological phenomena known to the present time.

The English-Electric Thunderbird, *a ground-to-air guided weapon, the handling of which was demonstrated*

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THE OIL INDUSTRY'S GUIDE

Eight hundred pages of information about the petroleum industry and its ramifications world wide. That sums up the forty-ninth edition of Walter E. Skinner's *Oil and Petroleum Year Book* which was published early in October. Complete and up-to-date details of over one thousand of the world's principal oil companies are given and can be relied upon. They include, as usual, data regarding directors, operations, capital structure, dividends, and other relevant available facts.

In addition there is a buyers' guide section in which the suppliers of equipment are listed under about a thousand headings. A list is also included of over 700 names of managers, engineers, etc, and their companies. Maps include the trans-Canadian natural gas pipeline system and the oilfields of the Middle East.

Copies are obtainable from Walter E. Skinner, 20 Copthall Avenue, London, E.C.2. Price is 40s. (42s. 6d. post free).

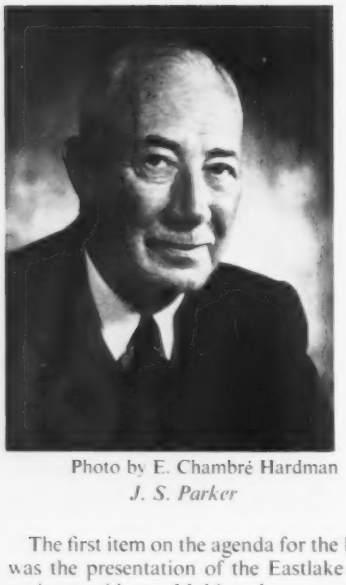


Photo by E. Chambré Hardman
J. S. Parker

Eastlake Medal presented to J. S. Parker

The first item on the agenda for the IP meeting on 1 October was the presentation of the Eastlake Medal to J. S. Parker, a vice-president. Making the presentation, **C. M. Vignoles,** C.B.E., the President, said:

I have a very pleasant duty to perform and that is to carry out the recommendation of the Awards Committee, which was unanimously approved by the Council, by presenting to J. S. Parker the Eastlake Medal.

As you well know, this Medal is awarded for voluntary service to the Institute and I feel that there is no more fitting recipient than Mr Parker. He first joined the Institute thirty-three years ago and, prior to being elected to the Council in 1945, had been particularly active in the branches. In this sphere he was a founder and a committee member of three branches—Northern, Stanlow, and Trinidad—and has twice served as chairman of the Stanlow Branch.

Among his first committee appointments after coming on the Council was to the Publications Committee, of which he is still a member. An important function which he fills on this Committee is the chairmanship of its Costings Sub-Committee, a function which he has performed continuously since 1950.

Publications have not been the only sphere in which Mr Parker has given us the benefit of his counsel for he has at various times been a member also of the Council Committees dealing with branches, bye-laws, education, election, engineering, house, public relations, and standardization. He is still a member of the engineering and of the house committees.

Mr Parker can I think rightly claim to be one of the parents of the *IP Review*. Mr Parker was one of the two people who wrote suggesting an extension of a section of the Journal to give wider information regarding the Institute's activities. As a result of those two letters the *IP Review* was born 14 years ago and is now a very widely sought-after publication.

One of Mr Parker's other activities is cinephotography and members have at times been privileged to see some excellent examples of his work in this field.

Mr Parker, in presenting you with this medal I would like to thank you for all your co-operation with us in the past and hope that we shall have the benefit of your counsel for a long time in the future.

The medal was then handed to Mr Parker amid prolonged applause.

J. S. Parker, after receiving the medal, said:

My sincere thanks to the Council for awarding me the Eastlake Medal and to you, sir, for conferring it upon me. I shall treasure it always as a memento of the many happy occassions and the many happy friendships I have experienced during my service to the Institute.

My thanks also for your kind remarks covering my service to the Institute and to the oil industry.

During the last war a descriptive phrase was in general use, "the backroom boys". I have had the opportunity over a number of years to be one of the Institute's backroom boys and my experience there has given me a great respect for the comradeship, the teamwork, and the service so freely given.

J. S. Parker addressing the members after receiving the medal

It is doubtful if the membership fully realize the extent of this work which results in the smooth running of the Institute's affairs. The individual may have his ideas but the bringing of these ideas into successful practice can only result from efficient teamwork.

I have enjoyed every minute of my sojourn with the backroom boys, those from our industry who have given their services so freely, and those from the permanent staff who have always shown such keen interest in furthering the operations of the Institute.

The individual receives the medal. I would appreciate it if in some way the honour could be spread over all the backroom boys with whom I have been associated. Successful results have in no small way derived from their endeavours.

On only one occasion have I really given an individual effort—the presentation of the *Archaeopterix* to the Institute as its crest. This medal thus has, to me, an enhanced value as it bears an imprint of the *Archaeopterix*.

It may considered that the London member has more opportunity to give service to the Institute than the member attached to a Branch. All my service to the Institute has been given whilst an active member of a Branch.

I trust that this award of the Eastlake Medal will be an incentive to Branch Members, who are becoming an ever increasing percentage of the Institute's membership.

I would take this occasion to acknowledge with thanks congratulations received from fellow members and from the backroom boys.

* * *

The Importance of Oil to Western Europe

On 25 September, J. H. Loudon, president of the Royal Dutch Petroleum Co. and a managing director of the Royal Dutch/Shell Group of Companies addressed the Netherlands Employers Federation. A summary of his talk follows:

There is an understandable desire in Western Europe to know first, how great is Western Europe's reliance on oil likely to be in the future and secondly, how sure Western Europe can be that its supplies of oil will be forthcoming.

The Nature of Europe's Demand for Oil

Western Europe's industrial expansion depends on the availability of adequate supplies of competitive energy. Demand for energy in Western Europe may be expected to grow at approximately 2½ per cent per annum. Coal is not expected to increase its contribution at a rate of more than ½ per cent per annum. Nuclear energy may make a contribution of 7–10 per cent of the energy market by 1975. Capital costs are high and plant must be used almost continuously. Nuclear power will supplement other forms of energy in meeting Europe's growing demand. Nuclear power is therefore complementary rather than competitive with other forms of energy.

By 1975, however, it can be expected on economic grounds that, whatever is done to increase production of other forms of energy, imports of oil into Western Europe will double or triple.

Challenge to the Oil Industry

From the oil industry's point of view there is little doubt that the challenge implicit in this growth of demand will be met. Oil reserves are ample. New methods of raising the rate of recovery may greatly increase the world's reserves of heavy oil. Exploration is going on in all parts of the world and will result in new discoveries, though these are unlikely to be comparable with those in the Middle East.

Changes in productive capacity in different parts of the world are reflected in changes in the pattern of oil movements. Venezuela is now the largest oil exporting country in the world and the countries of the Middle East both individually and collectively have greatly increased their contribution.

Fifty-Fifty

When crude oil supplies are plentiful, as they are at present, cost becomes the predominant consideration. Payment to host governments must be included under the heading of costs. The 50/50 principle is fair and equitable. It provides funds for development to governments and funds for oil companies to invest in all aspects of oil operation. These require sums of money beyond the capacity of the world's capital markets to finance.

New agreements in the Middle East, with one possible exception, do not diverge from the 50/50 principle. An innovation in some is that the host government becomes a joint shareholder in the venture, thus recovering the proportionate profit due to a shareholder in addition to the normal 50/50 share of profits of the foreign investment. The important aspect for producing countries to watch is that they do not increase costs in such a way that their oil is priced out of the market and the producing companies rendered less able to develop market outlets.

Economic Considerations

Oil imports into Western Europe are growing in cost, but the burden on the balance of payments of all commodities taken together is not growing at a pace that should be difficult for Western Europe's industries to match with exports. Changes in the pattern of imports reflect the changing structure of economic life. Cheap energy is vital for competitive exports. Further, oil imports create incomes in the producing countries which in turn can be spent on industrial exports from Western Europe.

With regard to reliability of supplies, it is true that political considerations can supervene, but the economic stake of producing countries in maintaining and increasing exports of oil grows stronger with time. The development needs of their internal economies require the importation of industrial equipment. This can only be paid for through the sale of oil and the consequent earnings of foreign exchange. There are signs that equation of mutal interest between producer and consumer is becoming increasingly accepted in the oil producing countries. The new government in Iraq, for example, has made some reassuring statements on this score.

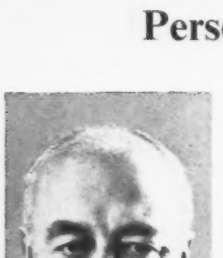
Conclusion

The answer to the two questions originally posed is therefore

1. that Europe's need for oil will increase considerably, doubling or tripling by 1975,

and 2. that so far as anything is certain in this uncertain world, oil supplies will be forthcoming in sufficient quantities.

Personal Notes



G. B. Howard-Rice

C. K. Stringer, managing director, Power Petroleum Company, retires on 31 October, and will be succeeded by **G. B. Howard-Rice,** who was until recently establishment services manager, Shell-Mex and B.P. Ltd.

Mr Stringer joined Shell-Mex Ltd, as it then was, in November 1925. Eighteen months later he was made assistant manager of the Company's Cardiff Division and in 1930 he was transferred to a similar post in Birmingham.

In 1938 he became manager of the Home Counties South Branch of Shell-Mex and B.P. Ltd, and continued throughout the period of the Petroleum Board as deputy manager, South-Eastern Region. In 1948 he became manager of the Board's North-Western Region.

When Shell-Mex and B.P. resumed independent trading he was made manager of Manchester Division and subsequently manager of the Company's North-Western Division in June 1950. He was transferred to London in 1952 and became retail sales manager in March 1954. In October of that year he was appointed managing director, Power Petroleum Company.

Mr Howard-Rice joined the former British Petroleum Company in February 1927 and held various sales posts in London until December 1938, when he was transferred to Cambridge as a superintendent.

He was made district manager, Leicester Division, Shell-Mex and B.P. Ltd in 1948; branch manager, Coventry in 1950; and divisional sales manager, Midland Division in 1952.

He returned to London as divisional sales manager, London Division in June 1954, and was appointed establishment services manager in Head Office in January 1957.

J. A. Higham, manager of the North-Eastern Division of Shell-Mex and B.P. Ltd for the last eight years, retired at the end of September. He is succeeded by **E. Rendall,** at present sales manager of Scottish Oils and Shell-Mex Ltd.

Mr Higham has served 39 years in the oil industry. He joined the British Petroleum Company Ltd at Birmingham in 1919 and served in many parts of the country as a sales superintendent before being appointed branch manager for Shell-Mex and B.P. Ltd at Leeds in 1938. During the war he became acting manager of the North Eastern Region of the Petroleum Board. He was appointed divisional manager on the formation of the North Eastern Division in 1950.

Mr Rendall joined Shell-Mex Limited in 1927, and served as a salesman before the war in London and Hull. After service with the Petroleum Board, he became fuel oil manager with Shell-Mex and B.P. Ltd at Leeds. In 1954 he was appointed manager of Birmingham Branch, and in 1955 sales manager of Scottish Oils and Shell-Mex Ltd.

John G. Hurst has recently joined the management of Petroleum Specialities Ltd, London, as one of the managing directors.

Vivian Zaayman, A.M.Inst.Pet., was recently appointed Shell's district manager at Bethlehem, South Africa. He served with Shell Petroleum at St. Helen's Court, London, during 1954 and 1955.

It may be of interest to note that Bethlehem is situated in the foothills of the magnificent Drakensberg mountain range not far from the famous Natal National Park, where the late Field Marshal Smuts entertained the Royal Family as his personal guests, during their 1947 South African tour.

Vivian Zaayman

We regret to announce the death of Professor Dr-Ing. Dr techn h.c. **Ernst Terres.** Born 1887, he carried out work on solvent extraction processes in association with the Edeleanu Company in Berlin and New York from 1933. After working for two years in London with the then Ministry of Fuel and Power, he became director of the Gas Institute in Germany and Rector of the Technical High School, Karlsruhe. Professor Terres was also president of the German National Committee for the Third World Petroleum Congress at the Hague in 1951, where he headed the German delegation.

Sir Alexander Fleck, K.B.E., F.R.S., D.Sc., has been appointed chairman of the Scientific Advisory Council to the Ministry of Power in succession to **Sir George Thomson,** F.R.S.

Sir Alexander Fleck, chairman of ICI Ltd since 1953 and this year's president of the British Association for the Advancement of Science, has spent a lifetime in the service of industry and applied science. He has rendered distinguished public service as chairman of many committees set up by Ministers of the Crown to enquire into scientific matters and the organization of large industrial enterprises.

Reginald William Fox

Reginald William Fox recently celebrated his 40th anniversary with Mobil Oil Company. During the past few years, Mr Fox has been the Company's Co-ordinator for Lube and Allied Products in the Technical Services Department.

For a period at the outbreak of the second world war he was secretary to the Petroleum Board Lubricating Oil Pool Technical Committee, one of whose tasks it was to formulate oil specifications for use by the oil industry in this country for the manufacture of its products during the war years. Mr Fox has also been a member of the Lubricating Oil Sub-Committee of the Admiralty Fuels and Lubricants Advisory Committee.

Mr Fox first joined Mobil in 1918 as works chemist at their Millwall Works. In 1924 he became assistant manager at Wandsworth, and in 1932 he moved to his present department.

Dr **Lyman W. Morgan,** previously a systems engineer for the Phillips Petroleum Co. and a research engineer at Georgia Tech. has been appointed associate professor in petroleum refining to the Colorado School of Mines, U.S.A. Dr Morgan has a degree from Massachusetts Institute of Technology and a Ph.D. from Georgia Institute of Technology.

Membership of the board of directors of Universal Oil Products Company has been increased to nine with the election of **Fred C. Koch.**

Mr Koch is chairman of the board of Koch Engineering Co., Inc, of Wichita, Kas., and has been associated with the oil refining industry in various capacities since 1924. These include president of Koch Oil Corp., Rock Island Oil & Refining Co., and Wood River Oil & Refining Co.

The new Universal director is also a member of the corporation of Massachusetts Institute of Technology and a director of Northern Natural Gas Co.

The following appointments have been made in the British Internal Combustion Engine Research Association:

Viscount Falmouth has been re-elected president of the Association.

Sir Harold Roxbee Cox, H. N. Pemberton (Chief Engineer Surveyor, Lloyd's Register of Shipping), **Professor O. A. Saunders,** and **Brigadier S. A. Stewart** (Director, Royal Engineer Equipment, Ministry of Supply) have been re-elected vice-presidents. **Rear-Admiral W. F. B. Lane** (Deputy Engineer-in-Chief, Admiralty) has also been elected as a vice-president.

G. B. R. Feilden (Engineering Director, Ruston and Hornsby Ltd) and **V. H. Hopkins** (Manager of Engineering, Diesel Engine Division, The English Electric Co. Ltd) have been elected to the council in succession to **G. W. Bone** and **A. C. Yeates,** who retired by rotation.

The council have elected **B. D. Giordan** (managing director, Bryce Berger Ltd) as their chairman, and Mr. Hopkins as their **vice-chairman.**

CASTROL DIRECTOR'S GOLDEN WEDDING

Arthur Franks, a director of C. C. Wakefield & Co. Ltd, and his wife recently celebrated their Golden Wedding.

L. M. Broadway, deputy chairman and managing director, presented on behalf of the Board a set of gold napkin rings to Mr and Mrs Franks on the anniversary day.

Mr Franks has been connected with the oil industry since 1903, mostly with the staff of W. B. Dick and Co. Ltd. On the outbreak of World War II he was appointed as chairman of the Oil Distributors Emergency Council, the organization set up to represent the wartime interests of practically the entire lubricating oil industry.

SCOTTISH CONSUMPTION OF PETROLEUM PRODUCTS

For the first half of 1958, the total deliveries into inland consumption of petroleum products in Scotland, excluding bunkers for ships engaged in the foreign trade, showed an increase of 229,307 tons over the same period last year.

Figures published by the Petroleum Information Bureau on behalf of the U.K. Petroleum Industry Advisory Committee show that the increases were largely attributable to increases in the use of gas, diesel oil, and fuel oil, of 41,372 tons and 88,168 tons respectively and in motor spirit with 41,834, tons, premier grades now exceeding the standard grade.

Of particular interest is the 52 per cent additional use of burning oil over that registered in January–June 1957, for unlike other products in that period, burning oil was not subject to official rationing or supply cuts. Full details are given in the following table.

Scotland Deliveries into Inland Consumption of Petroleum Products*

Product	*January to June*	
	1957	1958
	tons	*tons*
Aviation fuels	63,863	61,044
Motor spirit (incl. motor benzole):		
Premier grades...	96,141	133,055
Standard grades	106,815	111,735
	202,956	244,790
Industrial spirits (incl. industrial benzole)	18,177	22,300
White spirit	5,431	3,990
Kerosine:		
Burning oil	27,917	42,499
Vaporizing oil	33,438	25,255
	61,355	67,754
Derv fuel	98,082	114,901
Gas, diesel, and fuel oils ...		
Gas/diesel oil	119,992	161,364
Fuel oil	235,585	323,753
Refinery consumption ...	102,813	126,293
	458,390	611,410
Lubricating oils and greases ...	35,685	35,784
Paraffin wax and scale	739	887
Petroleum gases	4,938	5,380
Bitumen	77,892	72,280
Other products	105,213	121,508
TOTAL ...	1,132,721	1,362,028

*Excluding bunkers for ships engaged in the foreign trade.

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TANKER SAFETY CODE

The Tanker Safety Code, which is Part V of the IP Model Code of Safe Practice in the Petroleum Industry, will be available by the end of November. Like the other parts it will be published in loose-leaf form to facilitate amendment or addition. Copies may be ordered from the IP, price being 12s 6d post free for the Code only. Separate binders, large enough to contain all the Codes so far published, can also be obtained, price 15s 6d post free.

Notes of the Month

Formation of Dresser (Great Britain) Limited

That internation trade is a two-way street was the opinion expressed by J. B. O'Connor, president, Dresser Industries Inc, Dallas, Texas, in announcing a further Anglo-American collaboration with English business and industry for serving world markets through the organization of a new British firm to be known as Dresser (Great Britain) Ltd. The grouping of various Dresser operating units into this single organization will permit them to operate with greater flexibility and much more efficiently in the British Commonwealth and other countries within the Free Trade area.

The grouping and co-ordination of Dresser organizations in England, France, Italy, and other European countries will facilitate Dresser's forward-looking plans to serve the European Common Market and Free Trade area to the fullest extent possible.

(Left to right) *M. J. Galpin, director of Dresser (GB) Ltd; J. B. O'Connor, president Dresser Industries Inc, Texas; D. Cox, president Dresser AG, Zurich; J. N. MacKendrick, president Clark Bros. Co., one of the Dresser Industries, New York*

Mr O'Connor pointed out that the Group already had a number of licencees in England, and further stated that he thought that the planned Free Trade Area would come into effect through the competent and continued leadership of the British Authorities. The recently consummated agreement with Armstrong Siddeley Motors Ltd, a member of the Hawker-Siddeley Group, and their appointment as licensed manufacturers of Clark Gas Turbines in the U.K., as well as Dresser's earlier agreement with Ruston and Hornsby for the manufacture of their English turbines by Clark Bros. Co. at Olean, New York, were both efforts to further joint Anglo-American trade activities.

In addition to Armstrong Siddeley Motors Ltd and Ruston and Hornsby agreements mentioned above by O'Connor, other Dresser licensing agreements include those between Clark Bros. Co. and Alley & MacLellan (Polmadie) Ltd, for the manufacture of Clark engines, compressors, and gas turbines in the U.K.; Pacific Pumps and Ideco Inc's agreements with the Pulsometer Engineering Company Ltd for the manufacture of Pacific pumps for the petroleum refining, chemical, and other industries, and Ideco mud pumps; Ideco Inc., also had an agreement with Woodfield Hoist and Associated Industries Ltd, covering Ideco full view masts, drilling rigs, and other oilfield drilling equipment; Roots-Connersville Blowers Division agreement with W. C. Holmes & Company Ltd for the production of blowers and air-handling machinery and the agreement between Southwestern Industrial Electronics Company and Ernest Turner Electrical Instruments Ltd with regard to the manufacture of certain geophysical instruments and equipment in the U.K.

Another Dresser British Organization, Security International C.A. undertake the sale of Security rock bits manufactured by Security Rock Bits Ltd, a Dresser & English Drilling Equipment Co. Ltd joint operation.

In conclusion Mr O'Connor offered these suggestions as a recipe for better international trade relations—If we are to expand in the international market, U.S. and British industrialists should pool their efforts and resources. To retain technical superiority in the world, America and Britain must be able to compete with the science and research of the State Monopolies, and that this can only be done by joint co-operation between American and British business and industrial interests.

Both Americans and Englishmen must continue to have the courage to invest abroad, to give more freely of our resources and technical know-how in building other nations. We must build the buying power of the "have-not" countries if we are to expand these markets.

New Petrochemical Plant for Australia

Australia's first plant for the manufacture of epoxy resins, which will be marketed under the *Epikote* trademark, is to be built at Clyde, Sydney. This will be Shell's first chemical plant in New South Wales and their second in Australia. The other is the new sulphuric acid plant at Geelong, Victoria, scheduled to begin production in about five week's time.

The former plant is expected to be completed early in 1960, costing over A£600,000 and is designed to meet Australia's present requirements, with allowance for future expansion as the expected demand increases

It will manufacture both liquid and solid grades of *Epikote* resins which are valuable raw materials with wide application in the manufacture of paints and finishes. They are therefore especially in demand for drum and tank linings, coatings for refrigerators and washing machines, and chemically resisting paints for industrial equipment. The liquid grades are of particular value for electronic equipment, for printing of electric circuits in television sets, hearing aids, etc., and the "potting" of electrical units.

Epikote resins have been manufactured by Shell Chemical Company in the U.K. at the Shell refinery at Stanlow, Cheshire, since 1955. Overseas they are being manufactured in Holland, France, Germany, the U.S.A., and Canada.

Iranian Tankers

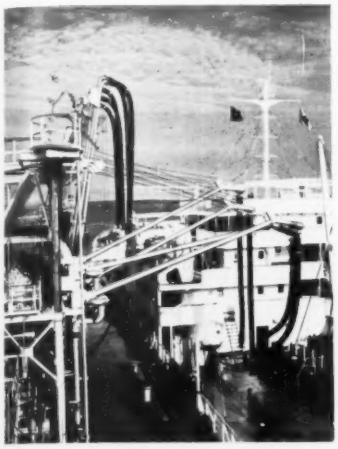
Iranian Marine Services Ltd of Bankside House, 107 Leadenhall Street, London, E.C.3 have been appointed managers of two new 33,000 tons dw oil tankers being built for the National Iranian Tanker Company of Teheran, who are joint owners in the new company with Galbraith, Pembroke & Co. Ltd, also of Bankside House, E.C.3.

Under construction at Verolme United Shipyards, Rotterdam the two tankers will operate on long-term time charter to major oil companies. The first vessel, *Reza Shah The Great*, is due to be delivered to the owners on the middle of December this year and the second, *Mohamed Reza Shah*, a year later. Messrs William Esplen, Son & Swainston Ltd are acting as consultant engineers and naval architects.

The Board of Directors of Iranian Marine Services Ltd will be Sir J. Gibson Graham, S.A. Maybud (Iranian), H. D. Walker, H. M. Walker, and John Graham.

Push-button Control at Kent Refinery's New Oil Jetties

Reputed to be the most modern installation in the U.K. for the rapid discharge of crude oil and the loading of refined products, is the latest type of overhead pipe gantry now in operation at two of the oil jetties of BP's Kent Oil Refinery.



Unlike the older system where the hoses linking the ship and jetty pipe manifolds are lifted into place by crane, on this new jetty each of the main pipelines from the shore terminates at one of the nine moveable booms on the gantry. These nine booms are 36-ft long and each is fitted with a 30-ft long rubber hose. By lowering and swinging a boom, its hose-end can be connected to a ship's manifold. Dual push-button controls at upper deck and jetty levels, operate the electric motors which raise and lower the booms.

The installation is designed to allow for a 60-ft rise and fall in the ship's manifold thus providing for all variations in the tide and the vessel's depth in the water according to its progress in loading or discharging.

The new installation can discharge crude oil at a rate exceeding 2000 tons per hour.

Exploration in France and Africa

The first deep test well in south-west France for the Société des Petroles de Valence, in which the BP group has a 50 per cent interest, has now reached a depth of some 5000 feet. This test well is in the St Julien-en-Born area of the south-west coast, for which the company received an exploration permit last year.

Société des Petroles de Valence is also searching for oil south-east of Lyons. In the Voiron permit area, which covers territory on both banks of the River Isere, two test wells are being drilled. In the south, the Beauregard-Baret No. 1 well has reached approximately 6500 feet, and the Brezins No. 1 well further north, 6000 feet. The latter well has given a number of slight indications of oil. In the north-east of the Voiron permit area a seismic team is continuing its survey.

The Société des Petroles du Senegal, in which the BP group also has a 50 per cent interest, is active in West Africa, where the Balandine No. 1 deep test well is at more than 9000 feet. This well is being drilled by a BP Exploration Company rig and crew.

Geophysical surveys are being carried out in the north of the Société des Petroles du Senegal permit area by three seismic teams, one of them from BP Exploration Company.

Recently the Société des Petroles de Valence (Sahara) received a new grant of permits and this company now has exploration rights covering 16,000 square kilometres in the Sahara. The first seismic parties will leave for the area in the near future. They will be followed soon after by a geological team, a member of which will be from BP Exploration Company.

New BP Tankers

On 30 September *British Fulmar*, 15,500 dw tons, the first tanker to be built for BP Tanker Company by Alexander Stephen and Sons, Ltd, at their Govan Yard was launched. She has an overall length of 525 feet and a breadth of 69 feet. A seven cylinder marine diesel engine will give her a loaded service speed of about 14½ knots. She was named by Mrs Caldwell, wife of J. M. Caldwell, managing director of Scottish Oils Ltd.

On the following day BP Tanker Company's largest tanker, the 42,000 dw ton *British Duchess*, completed her trials, after which she sails from the Clyde on her maiden voyage to the Persian Gulf to load a cargo of crude oil for discharge at one of BP's refineries.

British Duchess was launched by HRH the Duchess of Gloucester from John Brown and Company's Clydebank yard on 2 June. After fitting out on the Clyde, the vessel was dry-docked at Liverpool before starting her trials on 28 September.

With an overall length of 710 feet, *British Duchess* is 27 feet longer than the biggest ships—of 35,000 dw tons—at present in BP Tanker Company's fleet. The Company has on order vessels up to 65,000 dw tons.

Captain H. I. McMichael, O.B.E., Commodore of BP Tanker Company's fleet, is in command of *British Duchess*.

The British Duchess *on her trials off the Isle of Aran*

Nigerian Oil Search

In the search for oil in Nigeria, there have been two further disappointments in exploration wells drilled in the Eastern Region.

The first was the Ohuru exploration well, in Owerri Province, 27 miles north-east of Port Harcourt, which has found only traces of oil. The other was at Aiddo, 28 miles north of Enugu, the Eastern Region capital, where the exploration well proved to be dry.

The significance of the find at Ohuru cannot be assessed until further testing has been completed. The well reached a total depth of 10,000 feet.

The Aiddo well, the northernmost so far drilled by Shell-BP, reached a total depth of 10,544 feet.

Visit to Coryton Refinery

As a preliminary to the "Open House" days at the refinery, Mobil Oil Company recently invited the Mayor of Southend and other local officials to visit Coryton. Here, from left to right, are:—Bernard Braine, M.P. for S.E. Essex; B. R. Fraser, refinery manager; Alderman B. S. Clarke, Mayor of Southend, and John Burrows, J.P., managing director of Southend Standard. *During the visit the party was told of the plans for the four visits to be held in October for local residents in Southend, and was conducted on a tour of the refinery's installations*

New Helium Plant to be Built in Oklahoma

Funds totalling approximately $12,000,000 have been approved by the Congress to enable the Interior Department to build a new helium plant in the Keyes natural gas field, Cimarron County, Okla. The plant would become the fifth operated by the Government.

The Department signed a contract last April with the Colorado Interstate Gas Company for exclusive rights to extract helium from gas produced by the company in the Keyes field. This field, about 15 miles from Boise City, Okla, is the best commercial helium-bearing natural gas source discovered since 1943.

Specifications for a plant capable of producing a maximum of 70 million cubic feet of natural gas daily—which would mean a yearly output of from 200 to 290 million cubic feet of helium—have been drawn up by the Helium Activity of Interior's Bureau of Mines. The Department expects to publish preliminary construction requirements soon, and actual building will begin at the earliest date possible, as helium from Keyes field is needed to alleviate a severe shortage of this lightweight nonflammable element.

The current annual consumption of 330 million cubic feet is 70 times the amount consumed 20 years ago, and the four helium plants operated by the Bureau of Mines cannot keep pace with growing requirements. Although adding the Keyes plant to the helium production line could boost total output to approximately 600 million cubic feet a year, the Department believes that even this amount would fall short of the estimated demand soon after 1960.

However the Department is taking steps to obtain legislation for a large scale helium conservation programme.

Advance in Trachoma Research

Harvard scientists, working in the laboratories of the Arabian American Oil Company in Saudi Arabia, have found a virus from a victim of trachoma which is toxic to small laboratory animals.

The discovery may aid research into the eye disease which impairs vision and causes blindness. It opens the possibility of treating efficiently and simply the viruses present in trachoma as they occur in various countries and regions of the world, to determine if they are closely related or are different in their properties.

The discovery was reported 12 September, in Lisbon, at the Sixth International Congress on Tropical Medicine by Drs J. C. Snyder, E. S. Murray, and S. D. Bell, Jr, of the Department of Microbiology of the Harvard School of Public Health. Dr Snyder is Dean of the Faculty of Public Health and Director of the trachoma research programme being conducted jointly by the Arabian American Oil Company and Harvard University.

The virus found in eastern Saudi Arabia was shown to be highly toxic for mice and gerbilles (a desert rodent) in the tests carried out by the group of scientists in Dhahran, Saudi Arabia. Although the members of the Aramco trachoma research programme have obtained more than 70 different viruses and other micro-organisms from the eyes of trachoma patients since 1955 when the field studies were begun, this is the first strain of virus from a trachoma patient which has been found toxic for small laboratory animals.

The discovery is important for trachoma research since it may provide a relatively simple laboratory method to show whether trachoma viruses from various countries and regions are closely related or very different in their properties. This is one of the main questions which must be answered before further progress can be made toward vaccination against trachoma.

The importance of the Harvard progress report lies in the widespread prevalence of the disease and in the severe social and economic damage it causes. Described by the World Health organization as a "serious social scourge," it afflicts many millions of persons in all parts of the world.

Trachoma does not kill, but it frequently impairs vision if not promptly treated and thousands of victims eventually become blind in one or both eyes.

No positive cure for trachoma is now available, although the "sulfa" group and certain other antibiotics seem to be partially effective.

Trachoma is widespead in the Middle East, the Far East, parts of South America, Africa, and Asia, and throughout central and eastern Europe. The Mediterranean basin is particularly affected. In some Middle East Areas 80 to 100 per cent of the inhabitants have or have had it.

Milford Haven Tanker Terminal

The first piles have been driven for the jetty being built at BP's new tanker terminal at Milford Haven in South Wales, while good progress is being made with preparing tank foundations and building tank bunds.

In all more than 600 steel piles will be needed for the 1350-feet long approach arm and 2300 feet jetty head which will have two berths to accommodate the largest tankers. A concrete decking will be laid on the piles, some of which will be over 100 feet long.

Popton Fort, immediately above the jetty, is being rehabilitated for use as offices. Inside the fort, foundations

have been laid for five tanks, four of which will hold bunker fuel and the fifth water. One and a half miles away earth bunds have been built around the sites on which eight large crude oil storage tanks will eventually be erected.

New Technique of Locust Control

A new method of controlling locusts in their early stages has recently been developed by the Desert Locust Survey Organization of the East African High Commission, with the co-operation of the Governments of the Sudan, Libya, and Ethiopia. This method, it is hoped, will increase the efficiency and may reduce the heavy cost of control campaigns.

The technique springs from the development of a simple inexpensive, spraying device consisting of a single spray nozzle fixed to the end of an upright extension of the exhaust pipe of a light reconnaissance vehicle. The pressure derived from the exhaust of the vehicle forces the liquid out of the tank, and also atomizes it as it emerges from the nozzle jet. The spray formed is allowed to drift down-wind on to vegetation on which locusts will subsequently feed.

Practical success depends to a large extent on the persistence of the insecticide deposit, since the longer the vegetation remains toxic to locusts the more locusts will be killed. Dieldrin, applied as a concentrated solution in oil, has proved to be a particularly suitable insecticide for this purpose, and has given spectacular results at dosage rates as low as ¼ pint per acre; the deposit on the vegetation remains effective for some five to six weeks.

The main economies to be gained lie in the reduction of transport costs, which are the heaviest item of expense in all anti-locust campaigns; the vehicle used to operate the sprayer can carry and distribute as much insecticide as would otherwise have been brought to the scene of operations in a five ton truck. In the latter case, being in the form of bait, the insecticide would then have to be unloaded and distributed mechanically or by hand.

To enable the various locust control authorities in the desert locust distribution region, covering 9 million square miles of Africa and Asia, to carry out tests under their own conditions, Shell are making available a limited number of these sprayers, together with trial samples of the special dieldrin oil solution. It is hoped that this service will add to the encouragement already given to the wider adoption of the new techniques by the Anti-Locust Research Centre and FAO, and thus assist in the fight against that old and voracious pest, the desert locust.

Low-temperature Diesel Fuel Trials

The conclusion drawn from extensive winter tests made by engineers of Esso Research Ltd is that simple modifications to the fuel system of many diesel engined vehicles could make a considerable difference to their ability to operate in very cold weather. This was said at a recent meeting of the German Society for Oil and Coal Science in Goslar, Hanover.

In Europe the popularity of diesel engines for commercial vehicles is increasing steadily, mainly because of their greater thermal efficiency and lower fuel consumption. These diesel-engined vehicles are used in all parts of Europe—from beyond the Arctic Circle to the Mediterranean—generally without any changes in the engine or the fuel system to compensate for changes of climate.

In the past, trouble has occasionally been encountered on cold mornings in the depth of winter. When diesel fuels become very cold, wax crystals begin to separate. With bad fuels this occurs at only a few degrees below the freezing point of water. The problem can be overcome by blending the diesel fuel with kerosine, but this is expensive.

The wax crystals accumulate in fuel lines and filters and eventually prevent the passage of fuel, so stopping the engine. If the fuel system is kept warm by heat from the engine, the wax crystals are prevented from forming.

The Esso Research work was designed to find out whether some designs of fuel systems were especially critical. It was also used to confirm earlier work which showed that laboratory tests can be used to predict the field performance of fuels. The tests were carried out last winter at Reit-im-Winkl in the Bavarian Alps and at Kiruna, just north of the Arctic Circle in Sweden. As temperatures as low as −35° C (−30° F) were encountered, the tests measured diesel fuel and fuel system performance under the severest conditions.

The results showed that the fuel system design is the main factor which decides the operability limit of a diesel-engined vehicle. Quite simple changes would in some cases considerably improve vehicle performance; these include the use of larger bore fuel lines with smooth bends, the removal of too-fine filters, and making sure that the fuel lines and tanks are placed within the engine cowling to keep them warm.

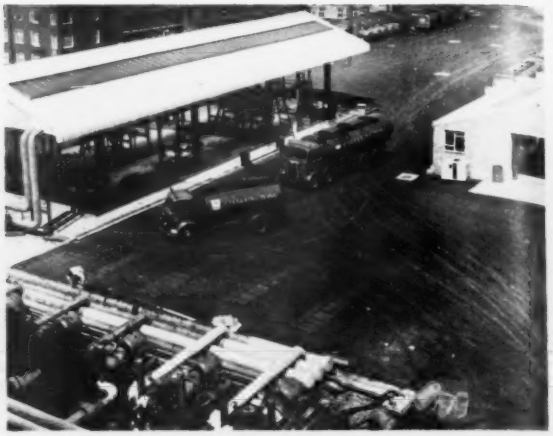
It was found that cloud point and pour point are the chief fuel properties that predict vehicle operability. Uncritical vehicles continued running at temperatures down to the pour point of the fuel, but those with less well-designed fuel systems ceased operating at temperatures even up to the cloud point.

An "ideal" low temperature fuel system can be designed from the Esso Research work. In this system, a gauze filter in the filler neck of the insulated fuel tank filters all fuel before it enters the tank, and no internal tank filter or suction pump strainer is necessary. Fuel pipes are at least 12-mm (½ inch) in diameter and are made of plastic material to reduce heat transfer. Acute angles are entirely eliminated, and fuel lines kept warm by running them within the chassis wherever possible.

These improvements would not only allow commercial vehicles to be operated right down to the pour point of the fuel—in some cases as much as 5° C (10° F) lower than at present—but would also simplify the task of supplying fuels satisfactory for use in all equipment at European winter temperatures.

Charringtons New Fuel Oil Terminal on the Thames

Complete Automation for Fuel Oil Deliveries



The loading bays

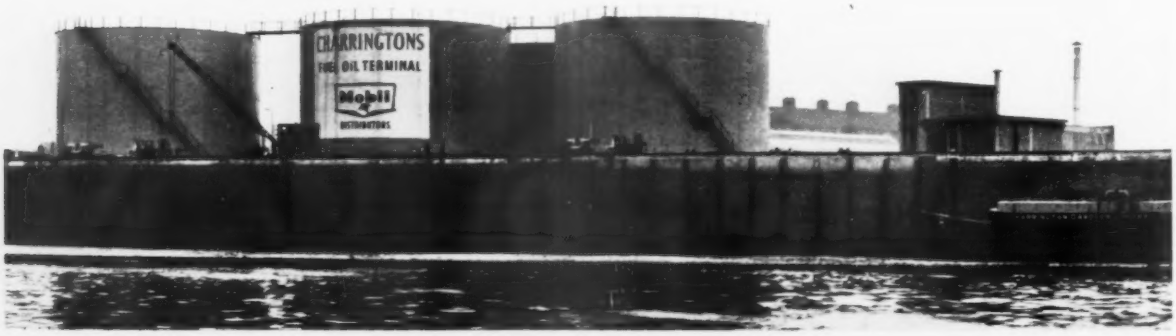
On 15 September, Charrington, Gardner, Locket & Co. Ltd opened one of the largest modern fuel oil terminals in the United Kingdom, just one century after the Company opened London's then most modern coal wharf, in the same area. Situated on the site of the old dock and railway sidings in Poplar, the new terminal covers over 4 acres and there are 6 more acres available for future development. Capable of storing over 4 million gallons of fuel oil, the new terminal has been constructed at a cost of over £400,000. The official opening was performed by J. C. Gridley, chairman of Mobil Oil Co. Ltd who, in doing so, said, "We hear increasingly of the competition of oil with coal. We would do well to remind ourselves, however, of the first stage of that competitive process, which must surely be the competition of oil with oil. It is a consequence of this healthy competition within the oil industry, here and indeed throughout the world, that in the particular realm of fuel-oils, as in the other ranges of petroleum products, we are compelled to improve and maintain our quality; to cut production and manufacturing costs, and to improve the efficiency of our distributive systems and our service to our customers." Concluding Mr Gridley expressed the hope that the new depot would justify the substantial investment it represented and also provide scope for the further development of the very happy and successful association between the two companies.

One outstanding feature of the new terminal is the automatic pumping equipment which feeds the fuel oils from storage tanks to loading bays, and which ensures the loading of nearly 400,000 gallons per day.

Four products—Mobilheat, and Light, Medium, and Heavy Mobilfuels—will be stored at Poplar, being transported by river in 200-ton steel barges from Coryton refinery.

Poplar terminal has been built to ensure the prompt delivery of supplies to the steadily increasing number of new consumers in the London areas, whether in new factories and new buildings, or those converted from solid to liquid fuel. By its location it is designed to eliminate the risk of any dislocation of supplies caused by heavy traffic on the roads from Coryton or by bad weather.

The site of the new terminal was formerly occupied by Poplar Dock and its extensive railway sidings, both of which were owned by the Railways. In regular use until the war, it was heavily blitzed in 1940 and remained derelict and useless until 1956 when Charringtons concluded a long-term lease for the use of the premises. The entire dock was filled with 60,000 cu. ft of rubble. Building the terminal took two and a half years.



The new depot as seen from the Thames

PETTER W.I. WORKING GROUP AT MONSANTO LABORATORY

Recently the Petter W.I. Working Group of the IP Engine Tests of Lubricants Panel met at the oil additives technical service laboratories of Monsanto Chemicals Ltd at Newport, Monmouthshire. The purpose of the meeting was to approve the final draft of the test proceedure for the Petter W.I. engine which was originally developed by Monsanto at Fulmer Hall. During their visit to Newport the delegates took the opportunity of inspecting the new engine test laboratories which were described in our September issue.

Those shown in the photograph, reading left to right, are:—S. J. Woods (C. C. Wakefield and Co. Ltd), W. A. Wilson (Petrofina (G.B.) Ltd), P. F. J. Denbigh (Monsanto Chemicals Ltd), A. J. Lambert (Mobil Oil Co. Ltd), G. V. Taylor (Monsanto Chemicals Ltd), C. O. R. Bell (Monsanto Chemicals Ltd), D. Golathan ("Shell" Research Ltd), G. E. Sergent (Ministry of Supply, IFV Farnborough), J. A. Cockill (Orobis Ltd), P. Newman (British Petroleum Co. Ltd), W. A. Robshaw (Monsanto Chemicals Ltd), Dr E. P. Wright (Lubrizol International Laboratories), W. Fitzgerald (Esso Petroleum Co. Ltd)

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LABOUR STATISTICS FOR THE U.K. PETROLEUM REFINING INDUSTRY

The following figures are taken from the September 1958 issue of the *Ministry of Labour Gazette* (cf. previous figures given in the *IP Review*, 1958, **12**, 171)

Figures in italics are the averages for all the industries covered by the tables

	Men (21 and over)	*Youths and boys*	*Women (18 and over)*	*Girls*	*All workers*
No. of workers covered by remuneration statistics ...	20,246	802	1263	28	22,339
Average earning in last pay-week in April 1958 (shillings)	266/1 *253/2*	125/7 *109/7*	139/11 *131/3*	— *85/7*	253/8 *214/2*
Average number of hours worked in this pay-week ...	48·5 *48·0*	43·8 *44·5*	43·5 *41·2*	— *42·1*	48·0 *46·2*
Average hourly earnings in this pay-week (pence) ...	65·8 *63·3*	34·4 *29·6*	38·6 *38·2*	— *24·4*	63·4 *55·6*
			Males	*Females*	
Numbers employed (July 1958)			34,700	7500	42,200
Numbers unemployed (at 11 August 1958)			294	35	329

Books and Films

PIB Memoranda

Several interesting and useful memoranda have recently been published by the Petroleum Information Bureau.

The first of these deals with "World Oil Reserves", and shows that these have increased by 33,000 million barrels in the twelve months ending 1 January 1958, as shown below:

Estimated Proven Reserves of Crude Oil

Beginning of year	*Million barrels U.S.A.**	*World*
1925	7,500	n.a.
1935	12,177	23,000
1945	19,785	64,000
1950	24,649	80,000
1955	29,561	158,000
1956	30,012	190,000
1957	30,434	228,000
1958	30,300	261,000

*Estimates of API.

It is also noted that of the present reserves about two-thirds are to be found in the Middle East.

The memorandum goes on to explain the meaning of *proven* reserves as opposed to *possible* reserves, whilst future regional crude oil supplies and alternative petroleum fuel sources are also discussed.

Up-to-date issues of "Oilfields of the Commonwealth", "Oil in Latin America", and "Oil in the USA" are also now available. Each, in addition to a general review of the respective areas, gives itemized crude production figures for the last few years, as well as details of operations in each separate country. Good up-to-date black and white oil maps of each of the relevant contries in close detail, complete the memoranda.

The memorandum highlighting the British oil industry has been expanded and revised under the title "Oil in Britain", and gives a full basic description of this subject with a map of individual oil-fields and refineries.

These publications can be obtained free of charge from the Petroleum Information Bureau, 29 New Bond Street, London, W.1.

Safety in Air and Gas Drilling

An interesting bulletin on safety precautions which should be considered in the planning of air or gas drilling of oil wells, has been issued by Well Completions Inc, of Denver, USA.

The recommendations are sub-divided into the following categories; compressor location and accessory equipment, rig location and equipment, procedure prior to drilling, and drilling operations.

Copies of the pamphlet entitled *Safety Precautions and Recommendations Used in Air and Gas Drilling of Oil Wells* can be obtained from Well Completions Inc, Box 578, Aurora Station, Denver 8, Colorado, U.S.A.

The Story of Oil

The Assam Oil Company Ltd have produced a useful little booklet under the above title. Presented in memoranda form the publication gives, with sketches, a basic picture of the fundamentals of oil exploration and production. *The Story of Oil* should be especially suitable for use in schools and other educational establishments.

The European Gas Industry

The OEEC Gas Committee which was set up in 1956 has just published its first report *Gas in Europe—Production, Availabilities, and Consumption*, covering the period 1954–56.

One of the most striking points about the European gas industry is the way production and consumption conditions vary from one country to another. In some countries, *e.g.* the United Kingdom, Scandinavia, Luxembourg, Switzerland, Portugal, and Iceland, gas is mainly, or even solely, generated in the conventional type of gasworks. The transmission and distribution networks generally cover comparatively short distances. In other countries, the production structure is mixed and includes gasworks, coke ovens, and blast furnaces. In such cases highly developed interconnexion and even long-distance transport networks are sometimes needed to link up the production and consumption centres, *e.g.* in Germany, Belgium, France, and the Netherlands. In other countries again, natural gas is the main factor, as for example in Italy.

Production conditions are quickly changing with the discovery and exploitation of new sources of natural gas, the rapid development of oil refineries which produce residual gas, and the extension of transmission networks.

Moreover, it should be noted that the gas industry, placed at the cross roads of a certain number of basic industries, such as the coal, iron and steel, oil refining, and chemical industries, can in no way consider its economic problems in an isolated manner.

One of the main problems is how the gas industry can help to ensure that a country's primary and secondary energy resources are put to the best use. In several countries, *e.g.* Italy, Austria, France, and, to some extent the Netherlands, and Germany, the discovery of natural gas resources may help to remedy the energy shortage. In addition increased supplies of coke-oven and blast-furnace gas could replace other fuels and facilitate industrial expansion without increasing the demand for energy.

The Committee foresees that mainly owing to the increase in iron and steel output and natural gas production, gas will maintain its position among Europe's energy resources despite keen competition from other fuels.

The reports contains a detailed analysis of the gas industry in each of the countries of the OEEC area, indicating the part it plays in the energy balance of each. Production and consumption patterns are analysed.

A large annex of statistical tables give production and availability of gas in each country in recent years, and a forecast total for 1960; gas consumption and distribution by countries with a breakdown by major sectors of demand; production of natural gas by certain countries with details of distribution, and various statistics concerning coke ovens and blast furnaces.

The report is published at a price of 12*s* 6*d*. and is available in the U.K. from HMSO.

ASTM Lecture

The Edgar Marburg Lecture for 1957 presented to the ASTM by Everett P. Partridge was entitled *Your Most Important Raw Material* and dealt with the importance of water to the industrial well-being of the U.S.A.

The lecture, which has now been published, is concerned amongst other things, with the consumption, storage, conversion of energy, and various industrial uses of water.

Copies may be obtained from the ASTM, 1916 Race Street, Philadelphia 3, Pa, at $1.25 each.

THE CBMPE DINNER

The annual dinner of the Council of British Manufacturers of Petroleum Equipment was held this year at Grosvenor House, London, on 1 October.

The guest speaker, Dr James Taylor, M.B.E., D.Sc., director of ICI Ltd and chairman of Yorkshire Imperial Metals Ltd, spoke of the changing industrial scene, saying that there was no doubt but we were at the beginning of another industrial revolution based on automation and nuclear energy.

Remarking on the pioneering accomplishments of the petroleum industry in the field of mathematical machines and other forms of office and plant automation, Dr Taylor said that to the oil industry automation presented no challenge except as an increased opportunity for success.

On the question of the part to be played by the various energy sources in their striving to meet the colossal future requirements, he said that "when the atom finally is harnessed for civilian work, oil will be so hard pressed to fulfil the nation's energy demand that atomic energy will be welcomed. The ultimate problem is not what fuel will be crowded out, but what can come along to help carry a growing load."

Dr James Taylor, M.B.E., D.Sc., the guest of honour (left) *being welcomed by the chairman of the CBMPE, G. H. Thorne*

Dr Taylor concluded his speech by saying that he could not help but feel that oil was too precious a substance to burn and should be kept for the manufacture of petroleum chemicals. Pointing out the many interesting products now supplied by petroleum chemicals, he said that "the petroleum chemical industry offers a great opportunity to this organization. The requirements are stringent and complex, but as chemical technology is advancing, so is the technology of materials of construction. For example, the new metals such as titanium, zirconium, tantalum, and niobium, provide the oil industry with means of fulfilling equipment requirements which would have been impossible a short time ago."

Replying on behalf of the Council, its chairman G. H. Thorne mentioned the great success of the recent Chemical and Petroleum Exhibition held at Olympia, London, and continued by urging support on a like scale for the 5th World Petroleum Congress next year. The Council, Mr Thorne said, were themselves taking a stand at the Congress and would be very willing to give any assistance to anyone requiring it, both in London before June 1959 as well as at the Congress itself.

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Trade Literature, etc.

Company Change of Name

Bottogas Ltd, supplier of liquefied petroleum gases, is changing its name to Shell-Mex and BP Gases Ltd. The registered office will continue to be at Cecil Chambers 76-78 Strand, London W.C.2.

The new name reflects the closer integration which is taking place with its parent Group, Shell-Mex and BP Ltd. Products will continue to be marketed under the brand name *Bottogas.*

The gases propane and butane, supplied by the company, are being used increasingly in industry for, among other purposes firing metallurgical furnaces, the production of protective atmospherers for gas carburizing and carbo-nitriding processes, bright annealing, and the enrichment of producer gas.

The company will continue to supply *Bottogas Butane* in the domestic field for cooking, lighting, and heating.

Bottle Cleaning Detergent

The recently announced installation at the Esso Petroleum Co's Purfleet terminal of the first complete motor oil bottle-washing, filling, and sealing line in Great Britain is now reported to be using *Trimetso* silicate detergent made by Joseph Crosfield & Sons Ltd, of Warrington.

Industrial Consultative Service

A new free consultative service to welding users in British industry has just been announced by Eutectic Welding Alloys Co. Ltd, of Feltham, Middlesex.

Whessoe Ltd Reorganization

Whessoe announces the regrouping of departments concerned with design, tendering, and development to form an "Engineering Division". This new Division will parallel the existing works and erection divisions which are concerned with shop fabrication and site construction, and it will comprise three engineering Groups, each of which will embrace all staff and activities associated with a range of related products.

R. F. Bishop, M.A., A.M.I.Mech.E., manager of the new Division

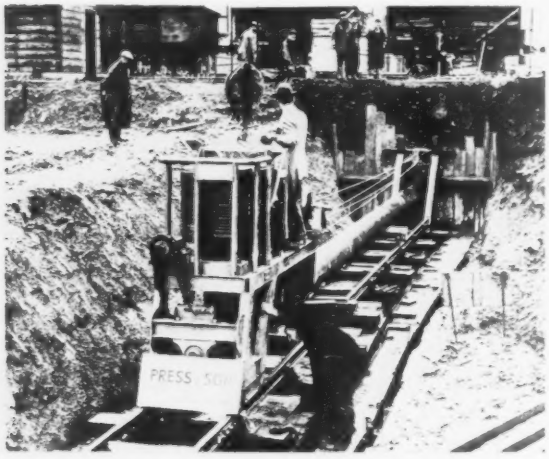
I. STORAGE — Tanks and storage installations for petroleum products and all other liquids, including low temperature liquefied gases; vapour conservation equipment, including floating roofs; and tank fittings and gauges, including the Shand & Jurs range.

II. PRESSURE VESSELS — Shop built pressure vessels to all codes; large site built vessels including spheres, bullets, and fractionating columns; wind tunnels and nuclear reactor pressure vessels.

III. CHEMICAL ENGINEERING — The traditional Whessoe range of gas treatment plant; heat exchangers; active carbon plants; and general chemical engineering plant and processes.

Auger Type Earth Boring Machine

In a matter of hours, 100 feet of 12 inch pipe was laid under the main Banbury to Paddington railway line without any disturbance to railway traffic. This achievement was carried out with the aid of an auger type earth boring machine recently acquired and owned by William Press & Son Ltd. and is one of the two of its size operating in the U.K.



The machine is capable of boring a steel sleeve or pipe up to 42 inches in diameter and virtually to any length. The greatest asset of the machine is that it can bore a sleeve under any public thoroughfare, railway, or canal without interrupting the traffic in any way. The reason for this is that the machine is in no way a "thrust bore". The cutting head is only approximately 1 inch in front of the actual sleeve, consequently as the hole is being cut so the space is immediately replaced by a steel sleeve, thereby ensuring complete safety and obviating any chance of a cave-in.

The principle of the machine is that the sleeve itself contains the auger which brings the excavated soil—supplied by the cutting head—through the sleeve and out under the machine. The forward movement is obtained by a power winch situated on the front of the machine, pulling on a "dead man" anchor near the cutting face. As the auger and cutting head rotates, power is supplied to the winch and the casing is pushed into the hole.

The advantages of the machine are said to be—non-disturbance of railway, road, and waterway traffic, quickness of operation, economy and safety under almost any conditions.

The photograph shows the machine in action during actual working conditions under the Western Region main line railway, outside Banbury station, where a 16 inch diameter sleeve was used for the laying of a 12 inch main, carried out for the Southern Gas Board.

£400,000 Order From Venezuela

Babcock & Wilcox Ltd have received a repeat order from C. A. La Electricidad de Caracas, Venezuela, amounting to approximately £400,000, for a large boiler, the third one of this size supplied by the Company to that electricity undertaking, which is responsible for the whole of the electricity supply in the Caracas area.

These boilers, which will be fired with oil, or with natural gas piped from neighbouring oilfields, are of the fully-pressurized *Radiant* type with a capacity of 550,000 lb. steam per hour at a pressure of 1300 p.s.i. and a temperature of 950°F. An interesting feature of the boiler design is that no expanded tube connexions are used; all boiler drums, superheater boxes, and similar ancillary parts are being fabricated at the works with welded tube-stubs for site-welded connexions.

Forthcoming Meetings

THE INSTITUTE

(*At* 61 *New Cavendish Street, London, W.*1., 5.30 *p.m.—tea* 5 *p.m.*)
Flow Properties of Distillates at Low Temperatures: A Review. J. F. Hutton, B.Sc. **Pumpability of Aviation Turbine Fuels at Low Temperatures.** Hugh Strawson, M.A. **3 December**

IP Economics and Operations Group

(*At* 61 *New Cavendish Street, London, W.*1., 5.30 *p.m.—tea* 5 *p.m.*)
The Design of Road Tank Wagons. A. R. E. Calcott. **11 December**

IP ESSEX BRANCH

(*At Railway Hotel, Pitsea*, 7.30 *p.m.*)
Film Evening. Presented by J. S. Parker, M.A., B.Sc. **17 November**
Fuel of the Future. R. S. Hopper and C. P. Humphris, M.A., A.M.Inst.F. **17 December**

IP FAWLEY BRANCH

Dinner-Dance (*At Montagu Arms, Beaulieu*) **14 November**
(*At Esso* (*Fawley*) *Recreation Club, Holbury*, 7.30 *p.m.*)
Atomic Achievements. T. A. Hall, Ph.D., D.I.C., A.R.I.C., A.M.I.Chem.E. **17 December**

IP LONDON BRANCH

(*At* 61 *New Cavendish Street, London, W.*1, *at* 6 *p.m.—tea* 5.30 *p.m.*)
Films in the Oil Industry. R. F. Leach, M.A., F.R.G.S. **20 November**
Film Evenings at Shell-Mex House. **5 and 12 December**

IP NORTHERN BRANCH

Annual Dinner-Dance (*Midland Hotel, Manchester*) **14 November**
(*At Engineers' Club, Albert Square, Manchester* 2, 6.30 *p.m.*)
Operation Pluto. A. C. Hartley, C.B.E. **18 November**
Film Show (*ABC Television Theatre*) and **Hot Pot Supper** (*Old Nag's Head Hotel*) **9 December**

IP SCOTTISH BRANCH

(*At Recreation Hall, BP Grangemouth Refinery*, 7.30 *p.m.*)
Electrostatics and Explosive Hazards in the Petroleum Industry. Dr A. Klinkenberg. **20 November**
(*At North British Hotel, Edinburgh*, 7 *p.m.*)
The Performance of High-Speed Diesel Engines. J. G. Withers (*Joint Meeting with the Institute of Fuel, Scottish Section*) **16 December**

IP SOUTH EASTERN BRANCH

Annual Ball (*Tudor House, Bearsted*). **14 November**
(*At King's Head Hotel, Rochester*, 7.45 *p.m.*)
Industrial Training Schemes. W. W. Evans. **2 December**

IP SOUTH WALES BRANCH

(*At the Training Centre, BP Refinery* (*Llandarcy*) *Ltd*, 5.30 *p.m.*)
Recent Developments in Refining. W. J. Newby, B.Sc. **13 November**
The Problem of Air Pollution. Professor W. G. V. Balchin, M.A., Ph.D., F.R.G.S., F.R.Met.S. **11 December**

IP STANLOW BRANCH

(*At Blossoms Hotel, Chester*, 7.30 *p.m.*)
Marketing Operations in the Petroleum Industry. T. H. Craig. **19 November**
Operation Pluto. A. C. Hartley, C.B.E. **17 December**

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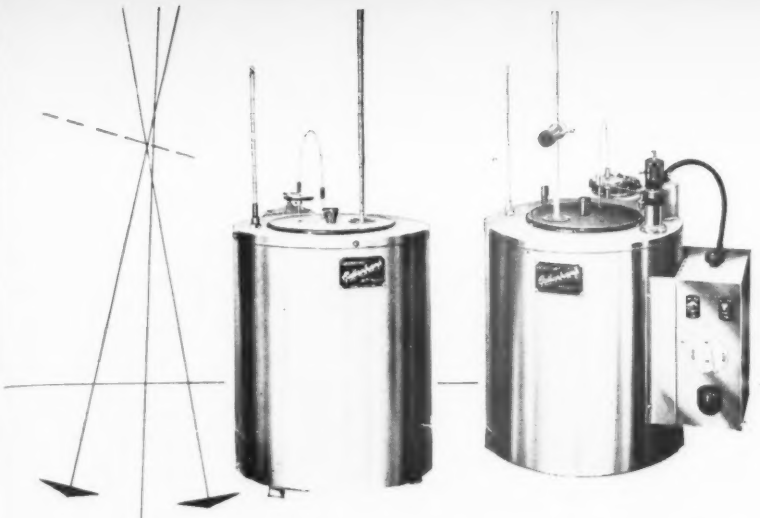

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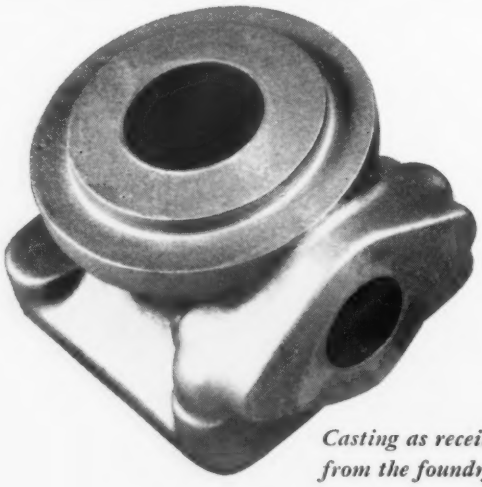

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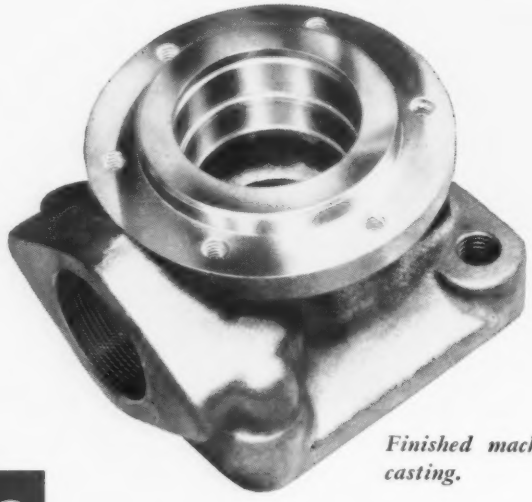

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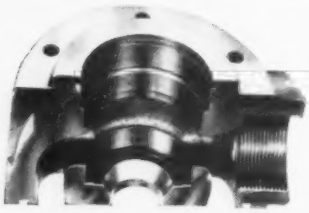

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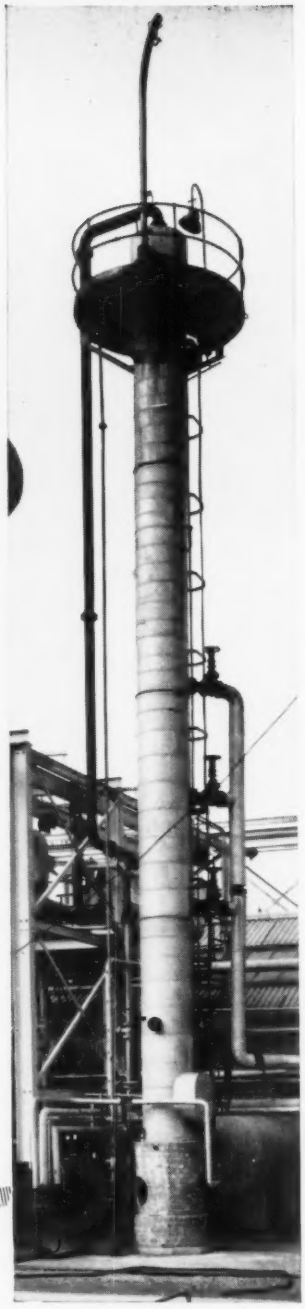

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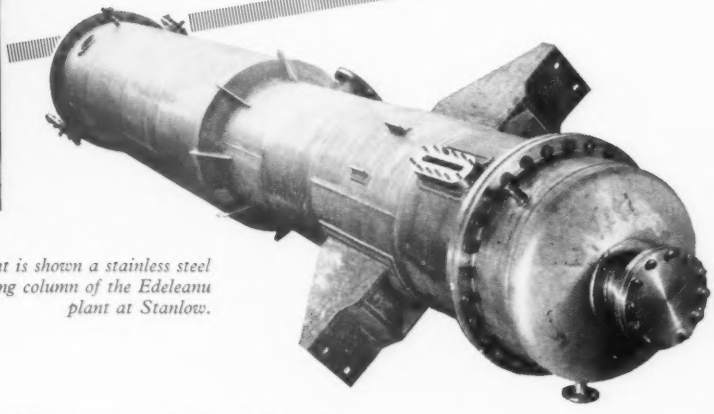
Left: Monel distillation column incorporating 40 "Turbogrid" distillation trays of 2′ 6″ diameter at Shell Refinery, Stanlow.



On right is shown a stainless steel SO_2 drying column of the Edeleanu plant at Stanlow.

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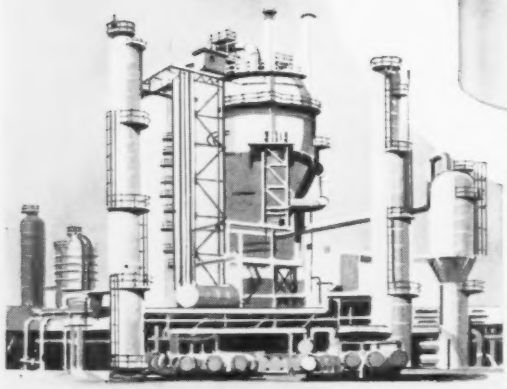

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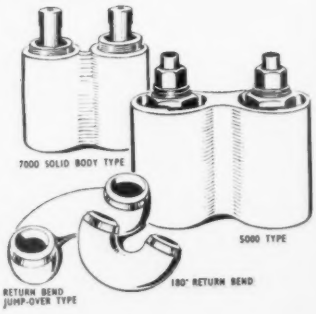

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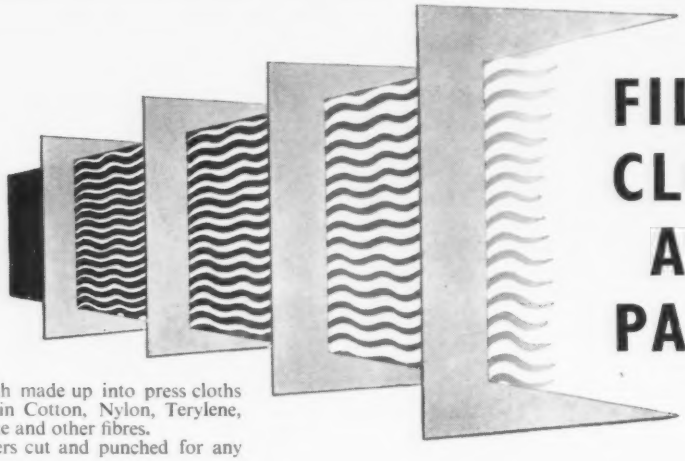

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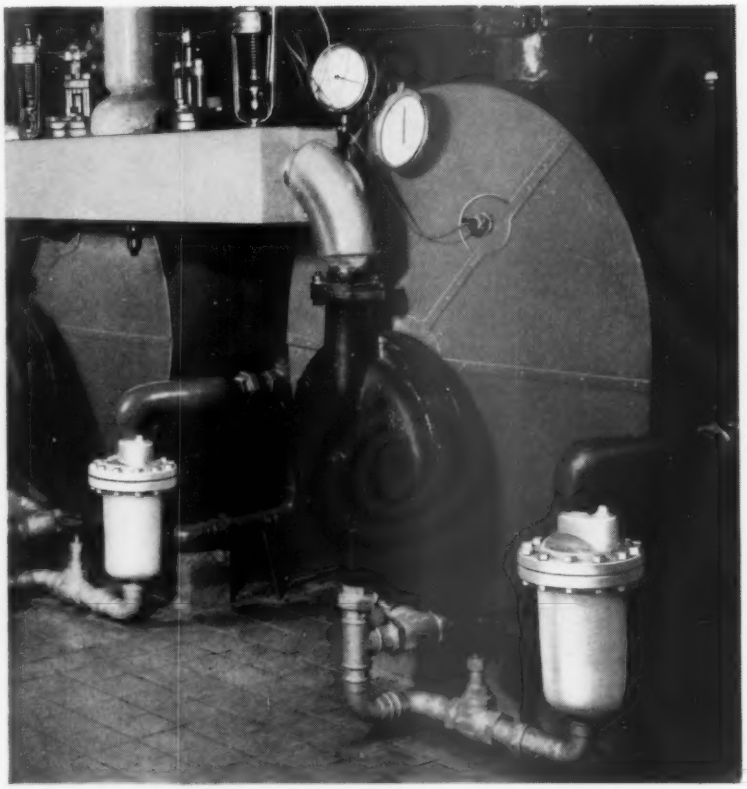

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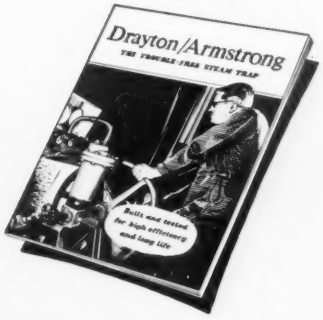

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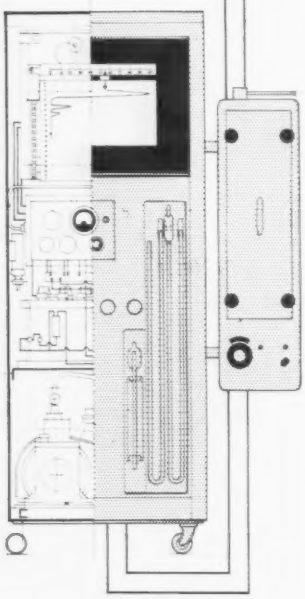

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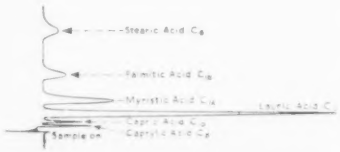

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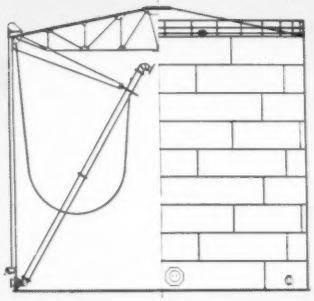

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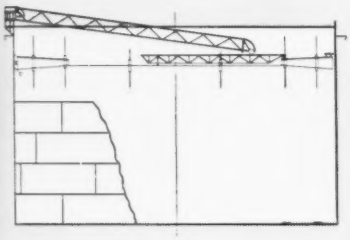

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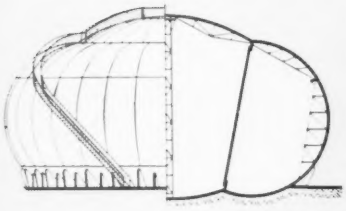

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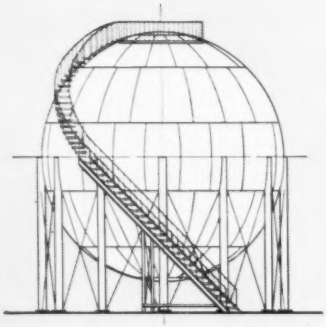

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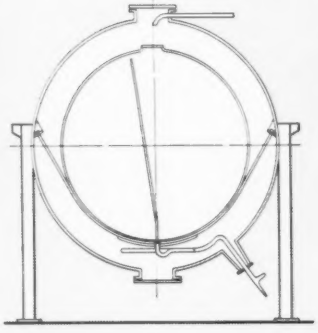

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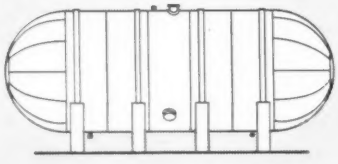

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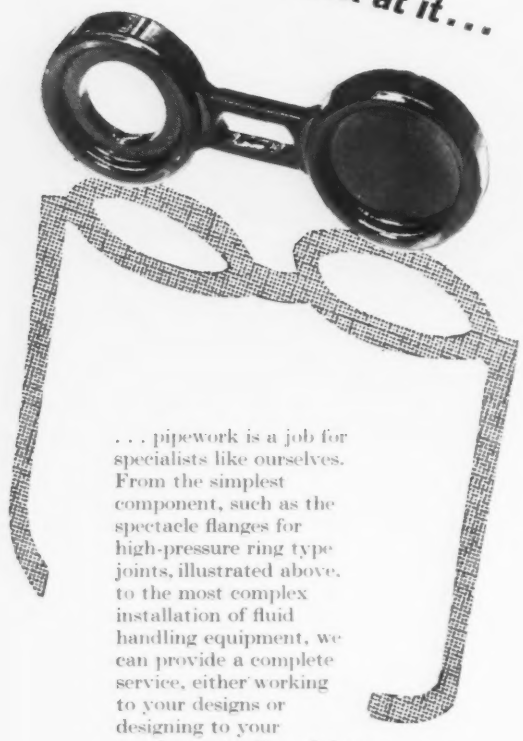

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Serck Radiators Ltd *(Longleys & Hoffmann Ltd)*	Oct.
Shell-Mex and B.P. Ltd *(Colman, Prentice & Varley Ltd)*	vi
Shell Petroleum Co. Ltd *(Grahame & Gillies Ltd)*	xxviii
Simmons & Hawker Ltd *(Broadway Advertising Services Ltd)*	xxvi
Peter Spence & Sons Ltd *(Holmwood Advertising Ltd)*	xiv
Stewart and Lloyds Ltd *(H. Raymond Morgan)*	June
Stone & Webster Engineering Ltd *(Thames Advertising Service Ltd)*	Inside Back Cover
Stothert & Pitt Ltd *(Trowbridge, Pritchard & Co. Ltd)*	i
Taylor Controls Ltd *(D. J. Keymer & Co. Ltd)*	May
United Steel Companies Ltd *(Rowlinson-Broughton Ltd)*	Sept.
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West's Piling & Construction Co. Ltd	Oct.
Whessoe Ltd	xxv

The 175 ft. high Isobutane Fractionating Tower of The British Petroleum Company's new Alkylation Plant at Isle of Grain.

The twist that cut Britain's dollar shortage

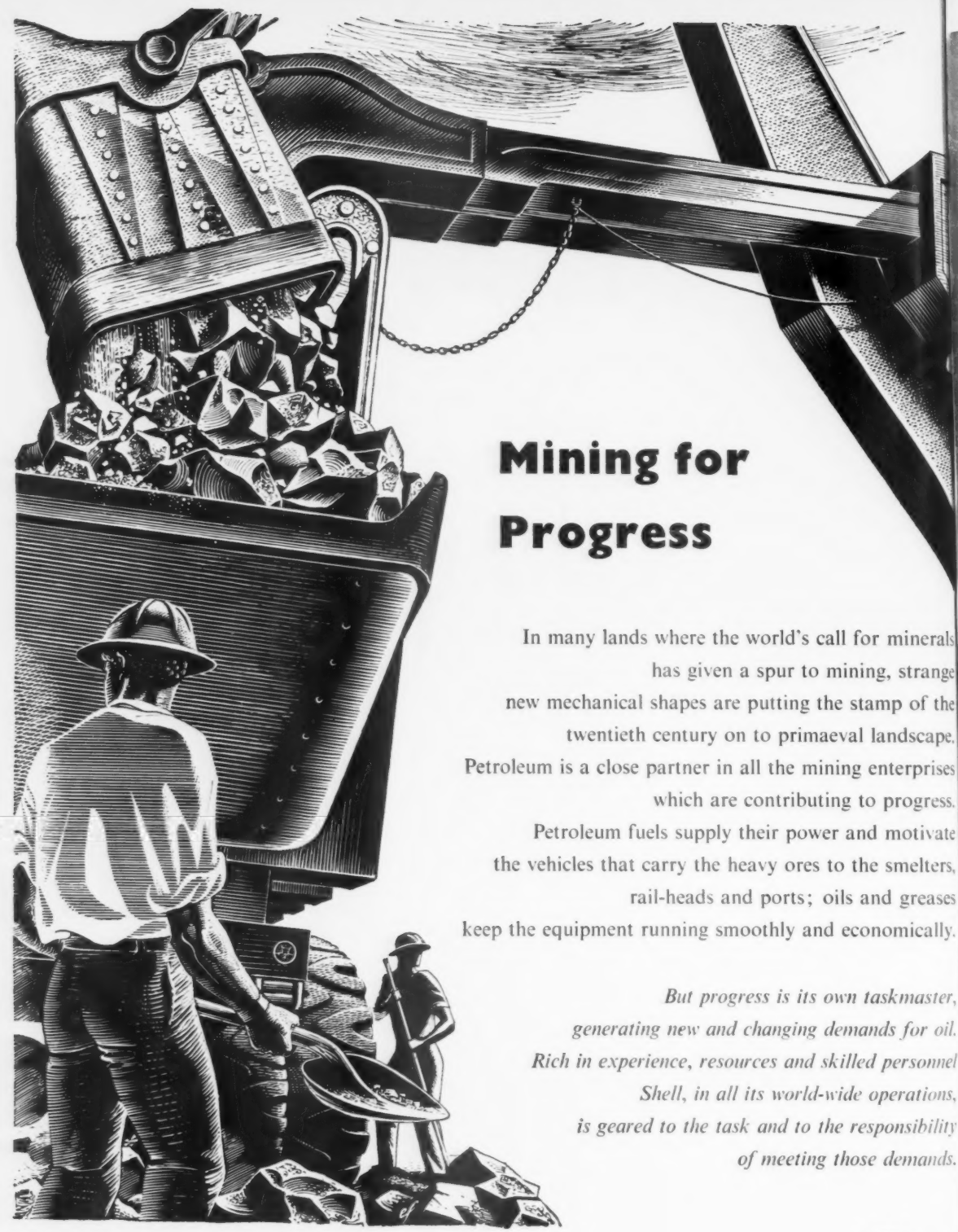
The technician twists the valve that recently set Britain's first Alkylation Plant 'on stream'. This plant is part of The British Petroleum Company's Kent Refinery on the Isle of Grain. This BP Refinery now has the only complete unit for making Avgas in Britain. The plant will produce 40 million gallons of Avgas a year.

Previously Britain had to buy most of her Avgas from the United States —and pay for it with 8 million dollars annually. Her economy could not easily afford these dollars.

The British Petroleum Company's new plant will therefore make a vital contribution to Britain's international trade balances.

BP

THE BRITISH PETROLEUM COMPANY LIMITED



Mining for Progress

In many lands where the world's call for minerals has given a spur to mining, strange new mechanical shapes are putting the stamp of the twentieth century on to primaeval landscape. Petroleum is a close partner in all the mining enterprises which are contributing to progress. Petroleum fuels supply their power and motivate the vehicles that carry the heavy ores to the smelters, rail-heads and ports; oils and greases keep the equipment running smoothly and economically.

But progress is its own taskmaster, generating new and changing demands for oil. Rich in experience, resources and skilled personnel Shell, in all its world-wide operations, is geared to the task and to the responsibility of meeting those demands.

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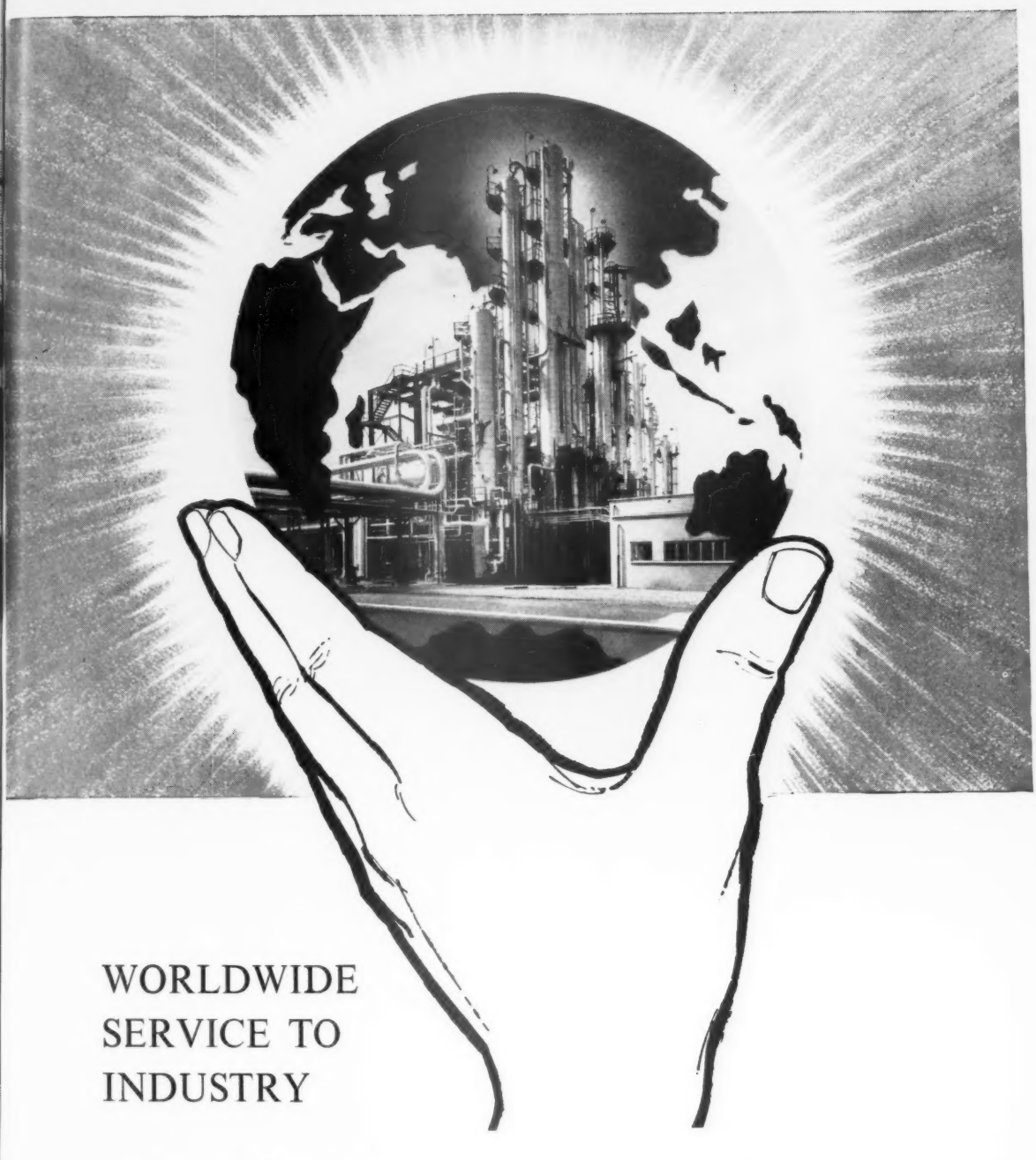

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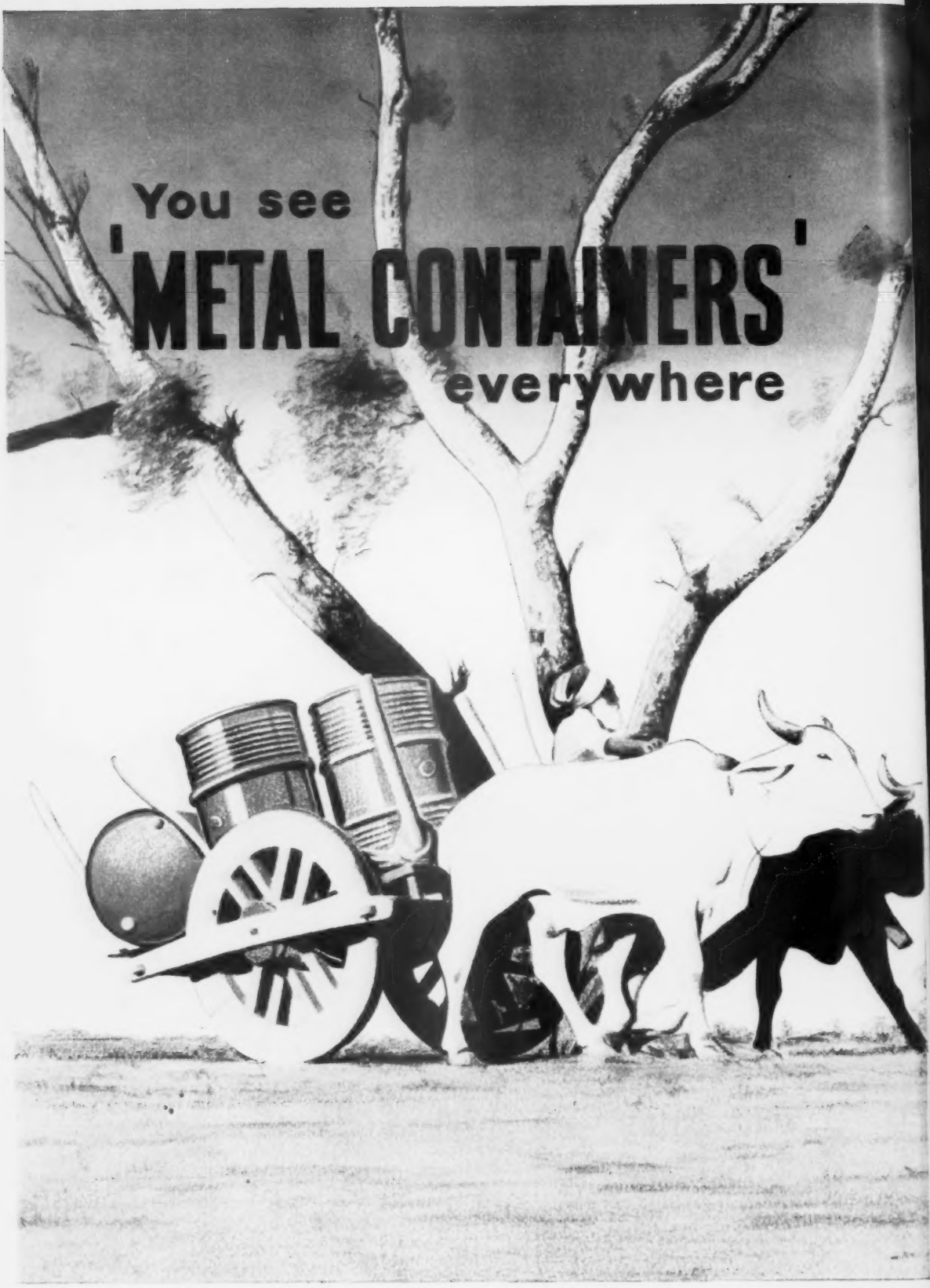

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